CT SYSTEMS, INC.

INSTRUCTION MANUAL

MODEL 3100

COMMUNICATIONS SERVICE MONITOR

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WARRANTY

1. CT Systems warrants all instruments against defects in material and workmanship for a period of one year after shipment. CT Systems agrees to repair or replace any assembly or component (except batteries) found to be defective under normal use during this period. CT Systems' obligation under this warranty is limited solely to repairing any such instrument which, in CT Systems' sole opinion, proves to be defective within the scope of the warranty when returned to the factory or to an authorized service center. This warranty may, at CT Systems' sole discretion, be void if the instrument ownership is changed during the warranty period.

CT Systems will assume all responsibility for UPS surface shipping charges for any warranty claims during the first thirty days from shipment date. After the first thirty days, CT Systems will assume responsibility for one way shipping charges, UPS surface, FOB customer's destination, during the warranty period. Should the customer desire an alternate method of shipping, he will be responsible for the difference between the UPS surface rate and the higher rate.

This warranty does not apply to any products repaired or altered by persons not authorized by CT Systems , or not in accordance with instructions furnished by CT Systems. If the instrument is defective as a result of misuse, improper repair, abnormal conditions or operations, repairs will be billed as per the CT Systems non-warranty program.

CT Systems assumes no responsibility for it's products being used in a hazardous or dangerous manner either alone or in conjunction with other equipment. CT Systems assumes no liability for secondary charges or consequential damages and, in any event, CT Systems' liability for breach of warranty shall not exceed the purchase price of the specific instrument shipped and against which a claim is made.

This warranty is in lieu of all other warranties, expressed or implied, and no representative or person is authorized to represent or assume for CT Systems any liability in connection with the sale of our products other than set forth herein.

WARRANTY PROGRAM

CT Systems further warrants each new instrument for an additional one year period at a subassembly level. This additional year warranty is limited to board replacement, exchange or repair at the sole discretion of CT Systems. The following specific steps must be followed to implement a subassembly replacement, exchange,repair or instrument return.

A. The customer MUST obtain a RETURN AUTHORIZATION NUMBER from the Customer Service Department. CT Systems accepts no liability for any instrument or subassembly returned to the factory without that number. Any correspondence regarding that instrument or subassembly should be referenced to that number.

B. A tag will be attached to any replacement subassembly sent by CT Systems. This tag will be clearly marked that it MUST be returned with the customer's subassembly being sent to CT Systems.

C. At the time a used replacement subassembly is sent by CT Systems, an invoice will be suspence-issued in the amount of 50% of new subassembly price, but held for no more than thirty days, pending return of the customer's subassembly. If the subassembly WITH TAG ATTACHED has not been returned within approximately twenty days, Customer Service will call to remind the customer that an invoice is pending. If the board, WITH TAG ATTACHED, is not returned, the invoice will be issued.

NON-WARRANTY

1. Subassembly replacement will be provided to the customer at 25% of the used subassembly price, pending the return of the item to be repaired. If necessary, a new subassembly may be provided at 75% of the new price, with an additional 25% suspence invoiced, pending return of the used subassembly.

2. Instrument repairs will be estimated and Customer Service will call prior to beginning work.

3. Any instrument repaired under non-warranty will be completely recalibrated and will be afforded an additional 45 day parts and labor warranty.

4 If the customer elects not to opt for the complete recalibration and extended 45 day warranty, then the repairs will be billed at an hourly rate, plus parts to fix the specific problem. Under these circumstances, a 45 day warranty will be extended to cover only those specific items repaired. If, in the process of repairing the instrument, other problems are discovered by Customer Service, the customer will be notified prior to any additional work being performed.

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SECTION 1

GENERAL INFORMATION

1.1 INTRODUCTION

The COMTEST SYSTEMS, Inc. Model 3100 is a compact, microprocessor controlled Service Monitor for testing FM, AM, and SSB transceivers. Its microprocessor provides it with extreme versatility and user friendliness. Its low weight and optional D.C. powered version permit convenient field use, from either internal battery or external 12 VDC sources.

The Model 3100 will generate and receive from 400 KHz to 1000 MHz in 100 Hz steps, but with a usable range from 100 KHz. Internal modulation sources provide a variety of choices covering most industry standard coded squelch formats. The generator output is continuously variable from 0.03 µVRMS to 316 mVRMS.

An internal CRT display shows modulation waveforms or a spectrum analyzer display, and may also be used as an oscilloscope. A meter reads Modulation, A.C. RMS volts, SINAD, or R.F. power.

In receive mode, the LCD display shows carrier frequency error, modulation frequency and decoded sub tones or digital coded squelch.

1.2 SPECIFICATIONS

1.2.1 GENERATE MODE

1.2.1.1 FREQUENCY

Range*	400 KHz to 999.9999 MHz *Usable range from 100 KHz
Resolution	100 Hz steps
Delta Frequency	Varies frequency in 100 Hz steps to ± 10 KHz
Generator Offset	0 to ± 12 MHz in 10 KHz steps or ± 45 MHz
Sweep Generator	Variable 500 KHz to 10 MHz around center frequency
Accuracy	See Time Base

1.2.1.2 R.F. OUTPUT

Range	0.03 µV to 316 mV
Impedance	50 Ω
Level Accuracy	0.2 µV ± 1.5dB 0.2 to 30 µV ± 2dB 30 µV to 224 mV ± 3dB
Spectral Purity	Non-harmonic <-50dBc within 30 KHz of carrier (all land mobile bands). Others: 2 signals, F1 and F2, F1 ≈ Fc + 21.5 MHz, <5 mV. F2 ≈ Fc + 43 MHz, same level as Fc
Residual FM	<50 Hz (300-3000 Hz BW)

1.2.1.3 MODULATION

FM

Deviation	± 18 KHz peak
Frequency	10 Hz to 10 KHz
Accuracy @ 1 KHz	± 4% @ 5 KHz
External Input	Variable, 600 mV for 5 KHz nominal

AM

Depth	80%, <5% distortion
Frequency	50 Hz to 10 KHz
Accuracy @ 1KHz	±4% @ 5 KHz
External Input	Variable, 1V for 100% nominal

PM

Deviation	± 18 radians
Frequency	300 Hz to 10 KHz
Accuracy @ 1 KHz	± 5% of full scale
External Input	Variable, 600 mV for 5 rad nominal

MIC INPUT — 5 KHz limiting in FM mode

1.2.2 RECEIVE MODE

1.2.2.1 FREQUENCY

Range	100 KHz to 999.9999 MHz	
Resolution	100 Hz steps	
Sensitivity	2 µV for 12 dB SINAD typical	
Bandwidth	Narrow	7 KHz
	Wide	100 KHz
Accuracy	See Time Base	

1.2.2.2 MODULATION MEASUREMENT MODE

FM	
Deviation	±18 KHz peak
Frequency	10 Hz to 10 KHz
Accuracy @ 1 KHz	±4% of full scale
FM Markers	±600 Hz and ±5 KHz 5% accuracy
AM	
Depth	0 to 90%
Frequency	50 Hz to 10 KHz
Accuracy @ 1 KHz	±5% of full scale
PM	
Deviation	±18 Radians
Frequency	300 Hz to 5 KHz
Accuracy @ 1 KHz	±5% of full scale
SSB	Provides BFO

1.2.2.3 SPECTRUM ANALYZER MODE

FREQUENCY	1 MHz to 999.9999 MHz,
SPAN	500 KHz to 10 MHz continuously variable
RANGE	+10 dBm to -100 dBm, 40 dB internal RF pads 70 dB log display
BANDWIDTH	Narrow 15 KHz Wide 80 KHz
LOG SCALE ACCURACY	±2 dB (0 to -60 dB ref)
MARKER	Positioned directly on the display where the RF center frequency is tuned

1.2.3 INSTRUMENT FUNCTIONS

1.2.3.1 FREQUENCY COUNTER/DECODER MODES

Display	4-digit LCD
Accuracy	Time Base ±1 count

MODES	RANGE	RESOLUTION
Bar Graph Freq. Error	0 to ± 9999 Hz	1 Hz, 10 Hz
Modulation	10 to 9999 Hz	1 Hz
Subtone	50 to 270 Hz	0.1 Hz
External Counter *	10 to 9999 Hz	1 Hz

*Usable frequency range to 19,999 KHz

DIGITAL SQUELCH DECODE

Automatic display of normal and inverted codes

1.2.3.2 POWER METER

Range	0 to 15 Watts 0 to 150 Watts
Accuracy	7% of reading ± 3% FS to 600 MHz 20% of reading ± 3% FS to 1 GHz
Maximum Power	150 Watts until the overtemp indicator lights and the audible alarm sounds (≈ 1 minute)

1.2.3.3 SINAD

Frequency	1 KHz
Range	0 to 30 dB True RMS, Linear Scale
Accuracy	± 0.5 dB @12 dB
Input Range	200 mVRMS to 6 VRMS

1.2.3.4 TRUE RMS AC VOLTMETER

Frequency	10 Hz to 100 KHz
Range	0 to 10 VRMS
Accuracy	± 5% of full scale
Input Impedance	100 KΩ nominal

1.2.3.5 OSCILLOSCOPE

Frequency	DC to 100 KHz
Range	0 to ±14 V peak
Accuracy	± 5% of full deflection
Input Impedance	100 KΩ nominal
Horizontal Sweep Range	0.01, 0.1, 1, and 10 ms/div, ±10% External and automatic lissajous

1.2.3.6 INTERNAL MODULATION SOURCES

Fixed 1 KHz	<1% distortion, 1.5 VRMS
Audio Synthesizer	
Range	10.00 to 9999 Hz, step size to .01 HZ
Resolution	4 Digits
Distortion	<1%
Modes	Continuous, or Burst Two-tone Sequential 5/6 Tone
Digital Squelch	all normal and inverted codes
DTMF	Full 16-key touchpad, with 11-digit group storage

1.2.3.7 TIME BASE

Standard TCXO	
Temperature Stability	±0.5 ppm, 0°C to 50°C
Aging	±1 ppm per year

1.2.3.8 SPECIAL FUNCTIONS

Programable step size for RF/Audio frequencies

20 complete sets of non-volatile storage registers for all keyboard settings

Self-diagnostics monitors major instrument parameters

1.2.4 GENERAL

Operating Temperature	0°C to 50°C
Storage Temperature	-40°C to 85°C
Power	103/117/220/240 VAC ±10%, ≈60VA
Mechanical	34 lbs, 15"W by 7-3/16"H by 17-1/2"D

1.3 ACCESSORIES

Protective Front Cover

Operator's Manual

Telescoping Antenna

1.4 OPTIONS

3108 Cellular Radio Testing

External Keyboard

Microphone

High Stability Time Base

Protective Soft Cover

DC Operation *

Battery Operation *
(must order DC option also)

Accessory Kit (includes microphone, antenna "N" to BNC adapter, scope probe, RF cables and SINAD test cable)

* Specify 117V or 230V Operation

SECTION 2

INSTALLATION

2.1 INTRODUCTION

The CT SYSTEMS, Inc. Model 3100 is a rugged piece of precision test equipment designed for portability. Although it is quite commonly used as a laboratory instrument, it is also well suited for field use.

2.2 UNPACKING AND INSPECTION

When unpacking the instrument, inspect the shipping container and instrument for shipping damage. Save the shipping carton and packing materials for possible future use.

WARNING
INSTRUMENT CONTAINS LITHIUM BATTERY

The microprocessor uses a lithium battery to retain memory when power is off. Lithium batteries are classified as hazardous materials. The lithium metal in the battery is a very active material which burns in the presence of water or high humidity. Do not incinerate, attempt to charge, or solder directly to the case. Do not dispose of the battery in ordinary trash. Consult state and local codes for disposal.

The instrument was inspected, given final operational and quality control tests, then carefully packaged for shipment, and should operate in accordance with the information contained in this manual.

If the instrument received has been damaged in transit, notify the carrier and your CT SYSTEMS, Inc. Customer Service representative. The representative will immediately arrange

for either replacement or repair of your instrument without waiting for damage claim settlements.

FOR CUSTOMER SERVICE call:

CT SYSTEMS, INC.
5245 HORNET AVENUE
P.O. Box 470
Beech Grove, IN 46107
317-787-5721

(or toll free outside Indiana)

1-800-245-6356

Ask for the TWO-WAY SERVICE DEPT.

2.3 WARRANTY INFORMATION

The Model 3100 is covered by a first year parts and labor warranty, and a second year module exchange program.

2.4 PREPARATION FOR USE

Before line power is applied, the meter should read zero, when placed in a normal operating position on a bench. If it does not read zero, insert a blade screwdriver into the opening below the meter and mechanically adjust it to zero.

2.5 POWER REQUIREMENTS

The instrument can operate from various sources of primary power selectable by the operator. The options for AC power are: 103 / 117 / 220 / 240 VAC 50/60 Hz at 60 VA. The three-conductor power cord provides a ground connection when it is connected to a properly grounded outlet.

With the optional D.C. powered instrument, it can also be operated from external D.C. power or the internal battery. On external D.C. power the instrument requires 10.8 to 14.5 VDC. Allow 16 hours of charging before using the instrument on internal battery power. For further details see Section 2.8.

For use with other primary power sources, please consult your Customer Service Representative.

2.6 ENVIRONMENTAL CONSIDERATIONS

The instrument comes equipped with bottom and rear panel feet. The rear panel feet also serve as cord wraps. It is also equipped with a carrying handle which can be used as a stand for the instrument. These features, as well as its small size and light weight, permit easy access in confined working spaces.

The instrument is designed to operate between 0°C. and 50°C., and should be used in areas where air flow around the instrument is not restricted. Do not permit the ventilation ports to be blocked or restricted, and **NEVER** operate the unit within its protective cloth cover.

NOTE

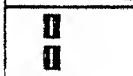
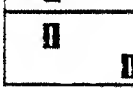
Exceeding the upper or lower temperature limits for extended periods, may not result in damage to the instrument but may cause degraded performance.

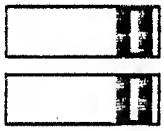
2.7 ENERGIZING THE INSTRUMENT

After careful visual inspection, you may proceed to connect the monitor to a primary power source and depress the ON/OFF switch. Initially, the monitor will energize all segments of the LCD display for a few seconds. Then it will enter a diagnostic mode during which it will check various critical points within the instrument. If a problem is found, the instrument will

display an error message on the LCD display, which will indicate an abnormal condition.

The instrument diagnostics continue to monitor the critical points as long as the monitor is in use. If an error message is displayed, you should contact your Customer Service Representative and describe the message on the LCD. If the instrument displays A8 UNCAL or A6 UNCAL check your line voltage and adjust the line voltage switches on the rear panel.

SWITCH	LINE VOLTAGE	FUSE
	103 ± 10%	1.25 A
	117 ± 10%	
	220 ± 10%	0.6 A
	240 ± 10%	

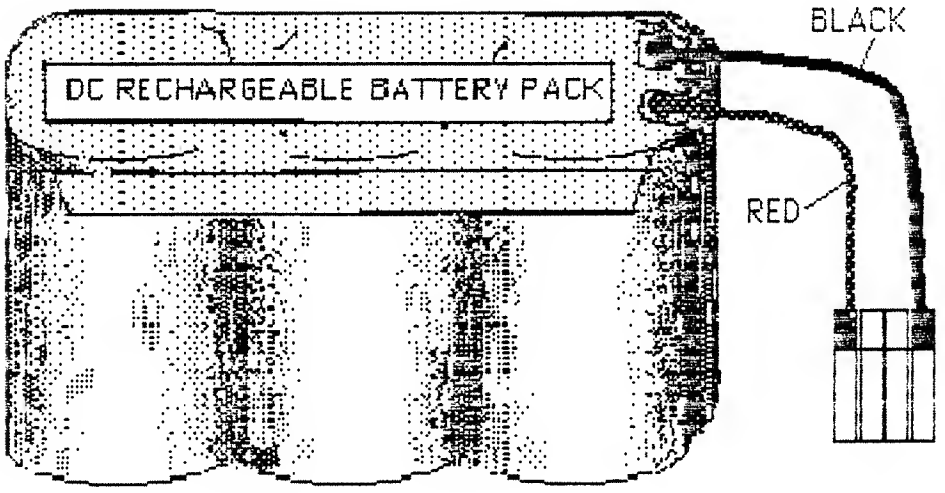


If no problems are found by the diagnostic program, the instrument will establish the conditions last entered on the keyboard. If the LCD displays *RCL FAIL*, and then 162.4000 Mhz, check the contacts on the lithium battery on the processor board. The Model 3100 Service Monitor is now ready for use. See Section 4 for operating instructions.

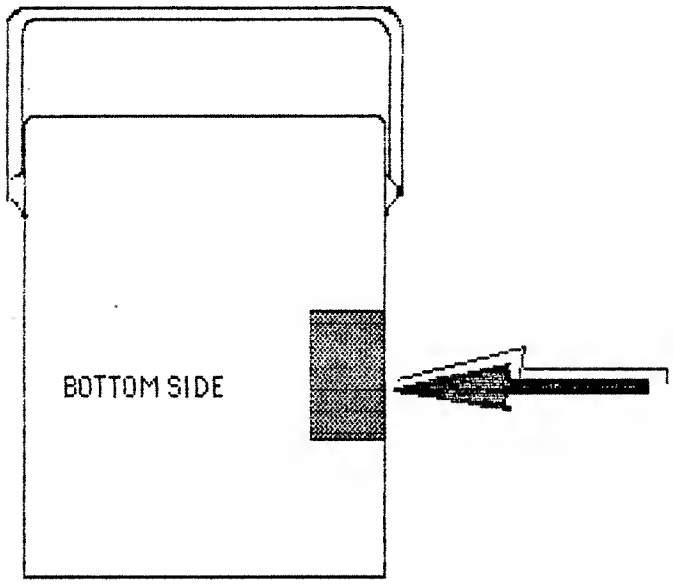
2.8 INTERNAL DC POWER OPTION

The Model 3100 may be ordered with an External DC option which allows operation from either AC, or a DC source of 10.8 to 14.5 Volts at ≈ 6 amps. The DC-powered units have a switch on the rear panel labeled INT/EXT. When the switch is in the EXTernal position, the instrument will be operated from a DC source connected to the RED and BLACK banana jacks on the rear panel. The red connector is for the positive and the black is for the negative. The instrument will operate on AC if the switch is set to the INTernal position and the AC power cord is plugged into an appropriate 117 Volt power source.

The DC-powered unit may also be provided with an optional internal battery. To access the battery compartment, the bottom cover must be removed. If the internal battery is installed and the rear-panel switch is set to INT, the instrument will operate when connected to AC power, or from the battery when not plugged in to an AC source. The battery will provide approximately 30 minutes of operation when the battery is new, and fully charged. The battery will charge to 90% of capacity in 1 hour with the instrument plugged in to AC and the power switch off. If the instrument is in use, it may take 8 to 10 hours to obtain a full charge on the battery.



INSTALLING A DC BATTERY PACK:



1. Remove the bottom cover of the unit.
2. Remove the battery compartment cover.
3. Install the battery pack and plug in the connector.
4. Replace covers.
5. Read Section 2.7 before energizing the unit.

BATTERY PACK CONDITIONING:

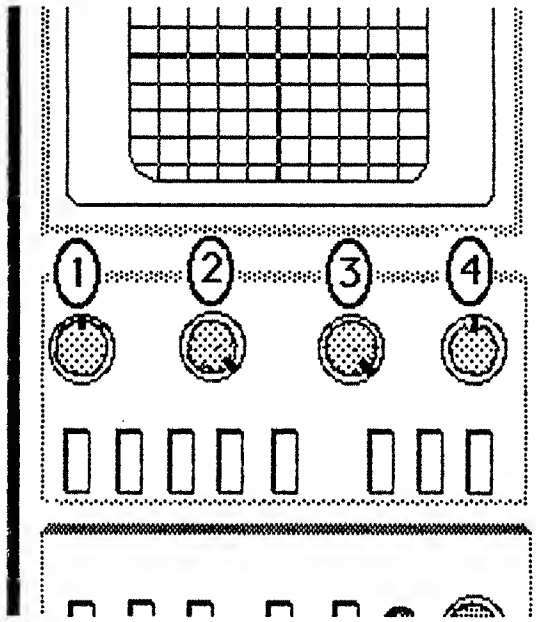
The usable life of the battery pack depends upon the frequency of use. After many repeated charge/discharge cycles, lead-acid battery cells become unequal, reducing the available charge. When the battery will only operate the instrument for ≈ 20 minutes, some increase in capacity may be gained by re-conditioning the battery pack.

To re-condition the battery pack, first float-charge at 14.2 Volts until the current drops to zero (approximately 8 hours). Then overcharge at 0.5 Amps for 30 hours. This over-charging procedure does reduce the longevity of the battery, so it should only be done when the capacity of the battery has reached a state of being almost unusable. Re-conditioning may be performed two or three times in the lifetime of the battery pack. When this procedure will no longer return the battery to a condition which will operate the instrument for ≈ 25 minutes, a new battery pack is indicated.

SECTION 3

CONTROLS

3.1 Oscilloscope/ Spectrum Analyzer

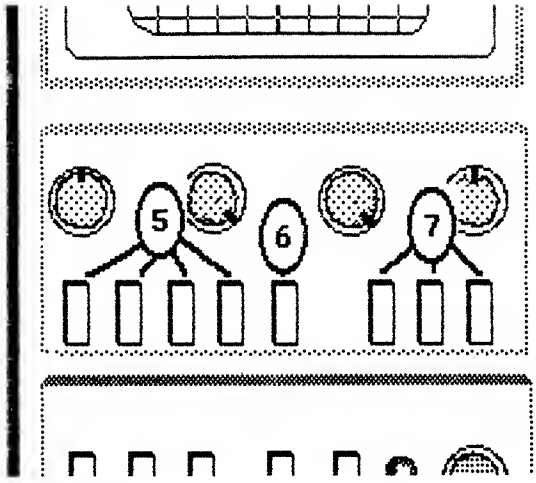


1. Controls the vertical position of the trace on the oscilloscope. It is not active in the Analyzer mode. Pull the knob to AC couple the oscilloscope (Volts mode only).

2. Varies the vertical gain of the oscilloscope. The full CW detent position provides calibrated levels which match the CRT graticule and the meter.

3. Provides variable control of the horizontal sweep speed of the oscilloscope. The full CW detent position provides calibrated sweep speeds. The control is not active in Lissajous, External or Scan modes.

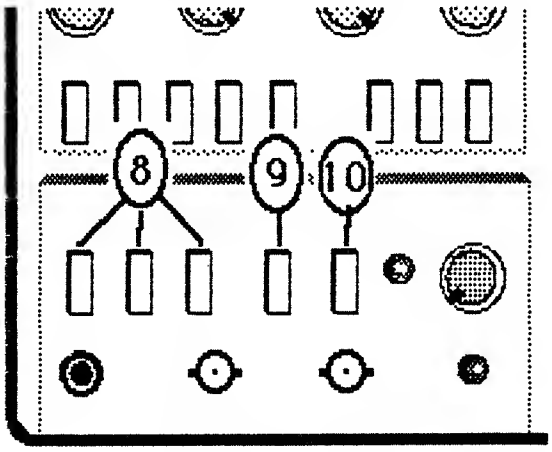
4. Controls the horizontal position of the CRT trace. For Lissajous mode, pull the knob and set the Audio Generator for the desired X axis input and frequency.



5. The four buttons select 10msec, 1msec, .1msec or .01msec/div sweep speeds. They are not active in External Horizontal or Scan modes.

6. Selects the External Horizontal mode when depressed. It is not active in Scan mode.

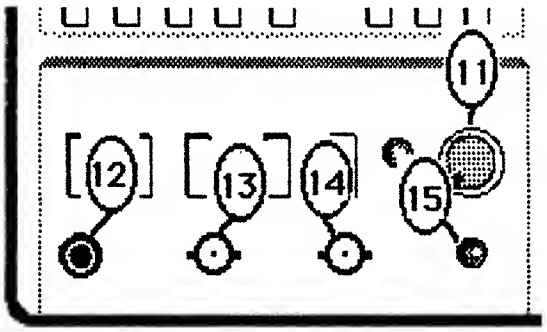
7. The buttons select electronic calibration lines on the oscilloscope for FM deviations of ±5 KHz or ±600 Hz. The calibration lines are accurate regardless of the position of the Vertical Gain control. These calibration lines are available only in RCV or DPLX/RCV FM MOD mode.



8. The buttons select 0, 20, or 40 dB of RF input attenuation (±10dBm, -10,-30 dBm top scale reference) for the Spectrum Analyzer. They are active only in the Analyzer mode.

9. Enables an "intensified spot" video marker at the selected RCV frequency. It eliminates the need for accurate horizontal position when in Scan mode. It is active only in SCAN mode.

10. Selects Spectrum Analyzer mode in RCV, or Sweep mode in GEN.



11. Controls the Analyzer "window" width in RCV, or the Sweep width in GEN mode. Minimum 50 KHz/div (CCW), or maximum 1MHz/div (CW).

12. ON/OFF control energizes the instrument. It does not need to be on to charge the battery in the optional DC powered instrument.

13. External Horizontal oscilloscope input. Active only when EXT HORIZ (*6 above) has been selected.

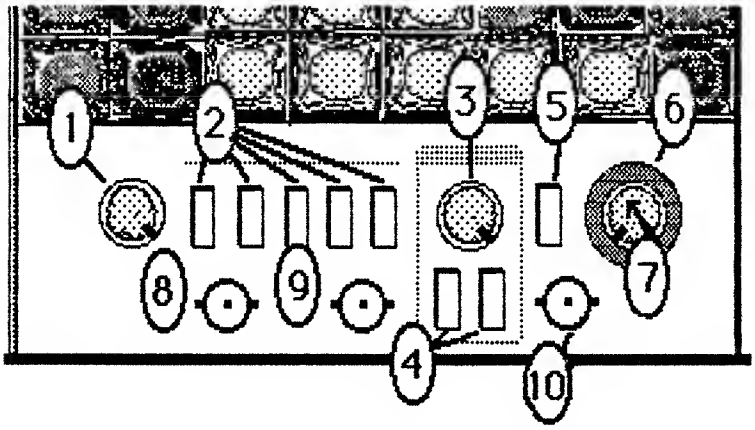
14. External Vertical input for the oscilloscope, voltmeter, and SINAD meter.

15. LED indicates adequate amplitude to operate the SINAD meter.

3.2 MODULATION/AUDIO

1. EXT LVL controls the level of external modulation sources applied to the EXT MOD connector.

2. MODULATION buttons select modulation types of AM, SSB, CW (none), FM, or ØM for generate or receive modes. In the generate mode, SSB produces standard AM modulation.



3. AUDIO/CODE LVL controls the level of the AUDIO GEN, and the special signaling functions 2 TONE, 5/6 TONE, DTMF, and DIG.

4. CONT & BURST buttons select continious or burst modes of the AUDIO GEN, and the 2 TONE, 5/6 TONE, and DIG signaling functions. In the AUDIO GEN mode, the signal remains on as long as the BURST button is held depressed. In 2 TONE, 5/6 TONE, or DIG modes, one DTMF sequence of signals is generated each time the button is depressed.

5. 1 KHz button selects a fixed 1 KHz tone.

6,7 The large knob controls the level of the fixed 1 KHz tone, and the small knob controls the speaker volume.

8. EXT MOD connector is the input connector for external modulation sources.

9. DEMOD OUT connector is the output connector for the de-modulated received signal.

10. MOD OUT is the output connector for the composite modulation from all internal and external sources.

3.3 KEYBOARD

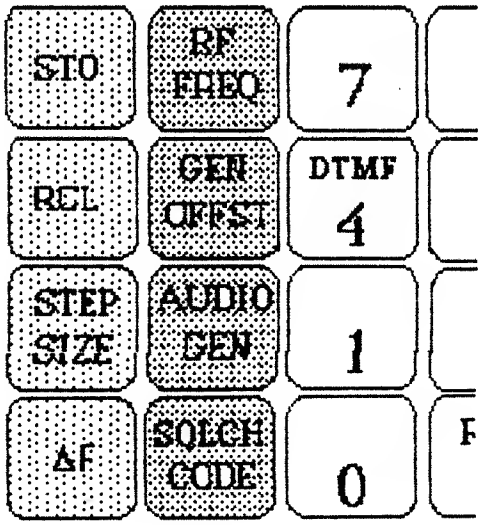
A. Function

STO function stores a complete set of keyboard entries (Frequency, Audio Tone, Generate Mode. etc.) about the current setup in one of twenty selectable memory locations. Locations are designated 0 thru 9 and .0 thru .9.

RCL function recalls complete setups from one of twenty selectable memory locations.

STEP SIZE function allows programming of RF FREQ, GEN OFFST, or AUDIO GEN step sizes.

ΔF function allows the RF frequency to be "rocked" around the selected center frequency, ±10 KHz, with the up/down controls in 100Hz steps.



RF FREQ function allows entry of a new RF frequency setting.

GEN OFFSET function allows entry of an amount by which the generate frequency may be offset from the receive frequency. This function is enabled only in the DPLX/RCV mode.

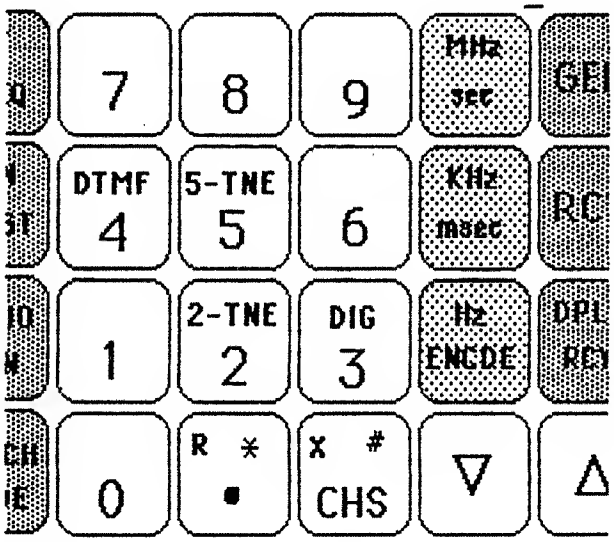
AUDIO GEN function allows entry of a selected audio frequency.

SQUELCH CODE function allows the choice of special signaling function (blue lettered keys in the data section).

B. DATA

The DATA key section consists of twelve keys arranged like a standard calculator keyboard for the digits 0 thru 9, decimal and CHS (change sign). These are followed by three "de-limiter" keys; MHz/sec, KHz/msec, and Hz/ENCODE. All numerical data entries must be followed by an appropriate de-limiter before the data will be accepted.

E.g. RF FREQ 461.375 MHz, or AUDIO GEN 136.4 Hz



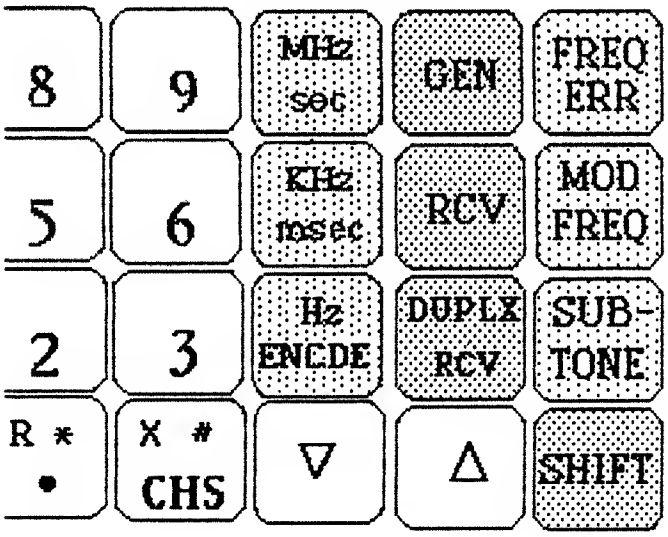
Also, **UP** and **DOWN** keys are provided, for stepping data (by a desired step size) such as RF frequency, GEN OFFST frequency, and AUDIO GEN frequency. A single push of the button produces a single increment in the indicated direction, while holding the button down will produce consecutive steps at a ten step per second rate. Data keys marked in blue are associated with special signaling functions, and are used after selecting the function SQUELCH CODE. When the display prompts FORMAT-, select one of the choices marked in blue (DTMF, 5 TNE, 2 TNE, DIG), then enter data.

C. MODE

GEN mode selects the generate function. The Mod meter and the oscilloscope display the audio waveform applied to the modulator when MOD has been selected in the meter section.
SCAN produces an RF Sweep when in GEN mode.

RCV mode selects the receive, or monitor function. In this mode, the RF output is turned off. The Mod meter and the oscilloscope display the de-modulated audio signal. SCAN produces a spectrum analyzer display.

DPLX/RCV mode selects a simultaneous generate-and-receive mode of operation. In this mode the generate frequency may be offset from the displayed receive frequency. The Mod meter and oscilloscope display the **received**, de-modulated signal.



D. DSPL

FREQ ERROR displays the difference between the received signal frequency and the selected receive frequency. SHIFT, FREQ ERROR displays a bar-graph analog display of frequency error. If the frequency error is less than 100 Hz for five seconds, the counter automatically shifts from 10 Hz resolution to 1 Hz resolution.

MOD FREQ displays the frequency of any tone modulation from 10 Hz to 9.999 KHz, 1 Hz resolution, with a usable range to 19.999

KHz. If the frequency is over (or equal to) 10 KHz you won't see the "1" but there will be an "OVFL" indication on the display.

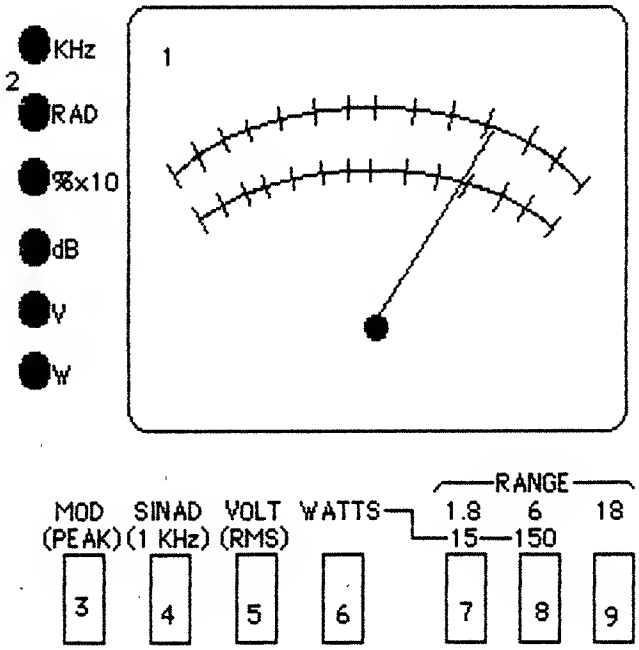
SUB TONE displays a count, to .1 Hz resolution, of any modulating frequency between 50 Hz and 270 Hz, regardless of whether or not any other modulation, including voice, is present on the received signal.

SHIFT SUB TONE displays decoded digital squelch codes. It will automatically display both the normal and inverted code.

3.4 METER

1. The meter measures peak modulation or True RMS volts on the top two scales, watts of RF power on the third scale, and dB's of SINAD on the bottom scale. In the MOD, SINAD, and VOLTS modes, the meter and the oscilloscope display the same information.

2. Annunciator LED's on the left side of the meter indicate which parameter has been selected.



3. The MOD button selects modulation to be metered. In GEN mode, the meter measures the audio signal which is being applied to the modulator. In RCV mode, or DPLX/RCV mode, the meter measures the de-modulated audio from the received signal.

4. The SINAD button selects SINAD information to be displayed, and is active in all modes with audio from a receiver applied to the EXT VERT connector.

5. The VOLTS button selects True RMS voltage to be displayed. It is active in all modes. The VOLTS mode measures the signal applied to the EXT VERT connector.

6. The WATTS button selects measurment of RF power applied to the RF IN/OUT connector. The RVS PWR/µV indicator illuminates when greater than 100 mw has been applied to the connector.

7. The button selects a full scale of 1.8 (top scale) for Mod or Volts, or a full scale of 15 for Watts. The range selections do not affect the SINAD scale.

8. The button selects a full scale of 6 (second scale) for Mod or Volts, or a full scale of 150 for Watts.

9. The button selects a full scale of 18 (top scale) for Mod or Volts.

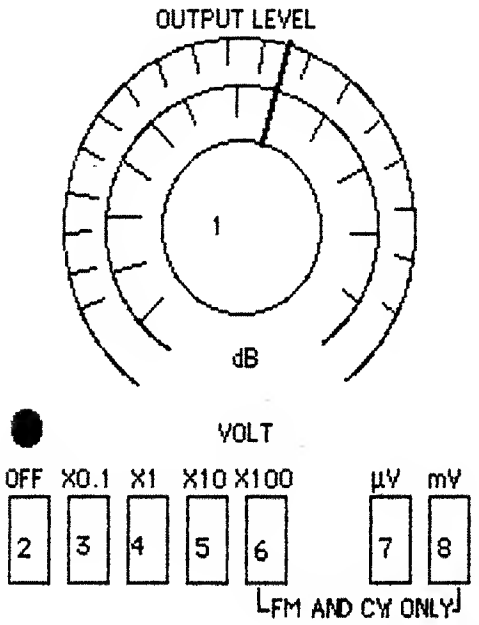
3.5 OUTPUT LEVEL

1. The variable level control (vernier) adjusts the RF output over a 23 dB range. It is calibrated in Volts (outer scale) and dB (inner scale).

2. The RF OFF button shuts off the RF output. The LED above the button indicates NO RF OUT when it is lighted. The RF is always off during RCV mode. *When in the GEN or DPLX/RCV modes, selecting RF OFF will allow keying the RF from a microphone connected to the rear panel MIC jack.*

3. The button selects mv or µv multiplied by 0.1.

4. The button selects mv or µv multiplied by 1.



5. The button selects mv or µv multiplied by 10.

6. The button selects mv or µv multiplied by 100.

7. The button selects µv output levels.

8. The button selects mv output levels.

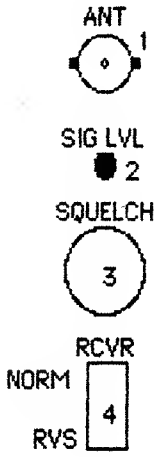
NOTE

When keying power into the RF IN/OUT connector, RF output power is limited to the µv ranges regardless of whether or not mv is selected.

3.6 IN/OUT

1. ANT connector is the input to the monitor for "off the air" signals. **CAUTION: 100 mw max!**

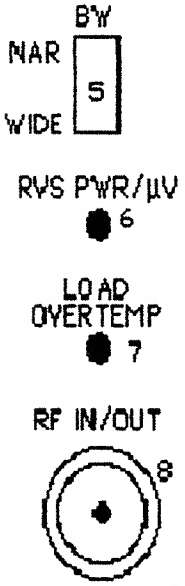
2. SIG LEV indicates that the receiver is unsquelched when the LED is lighted.



3. SQUELCH control sets the receiver squelch level.

4. RCVR button selects NORMal or RVS (REVERSE) L.O. injection. It is used to identify images in Spectrum Analyzer operation.

5. BW button selects either WIDE (100 KHz), or NAR (7 KHz) bandwidths for the receiver IF.

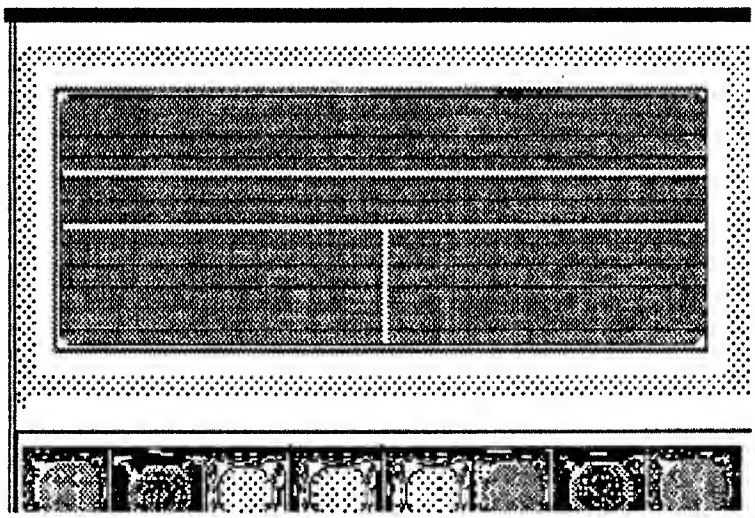


6. RVS PWR/µV indicates that RF is being applied to the RF IN/OUT connector (generator output is limited to µv ranges).

7. LOAD OVERTEMP indicates that the internal load has reached a temperature of 100°C., accompanied by an audible alarm. **Immediately disconnect the source when this occurs and allow the internal load to cool down.**

8. RF IN/OUT is the connector for the generator output and for transmitter testing.

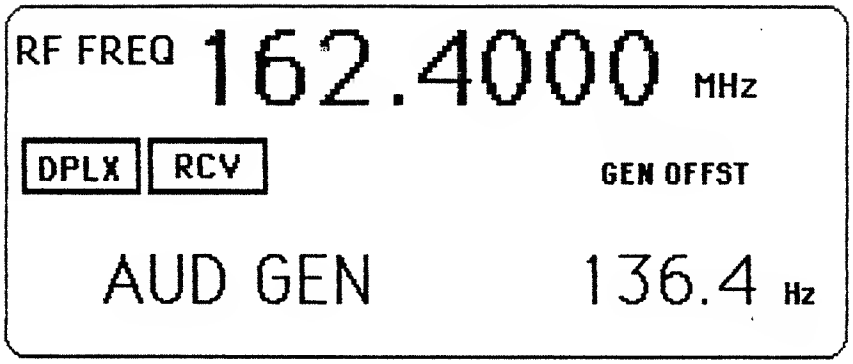
3.7 LCD DISPLAY



The LCD display is organized in four sections: the upper section, the center section, the lower left section and the lower right section.

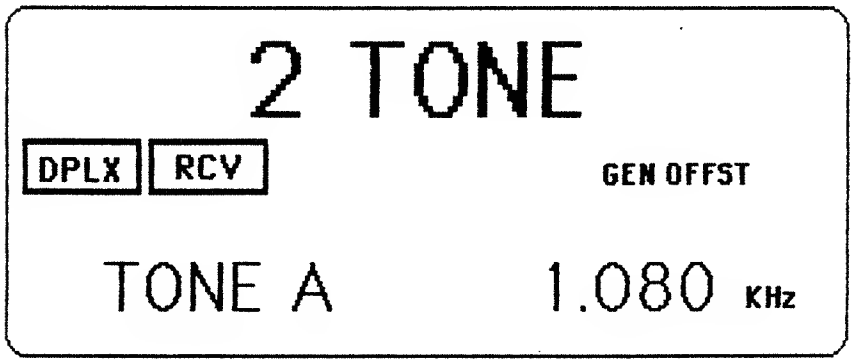
The upper section is used to display the RF frequency to which the generator is tuned in GEN mode, or the RF frequency to which the receiver is tuned in RCV or DPLX/RCV modes. It is also used to show STO/RCL information, diagnostic messages and tone signaling information.

The thin center section is used to display mode annunciators such as RCV, DPLX/RCV and GEN on the left side, and ΔF or GEN OFFST on the right side. *The ΔF and GEN OFFST annunciators are reminders that the generate RF frequency does not match the frequency displayed in the top section.*



The lower left section is used to describe the data displayed in the lower right section. The descriptions include: AUDIO GN, AUD STEP, RF STEP, GEN OFST, ΔF, FREQ ERR, MOD FREQ, SUBTONE, DIG RCV, and tone signaling information such as TONE A, DUR A, DELAY A, TONE B, etc. (for TWO TONE), the presently stored DTMF number, or the presently entered code for 5/6 TONE. It may also display a bar graph of FREQ ERR.

The lower right section displays data for the functions described in the lower left section.

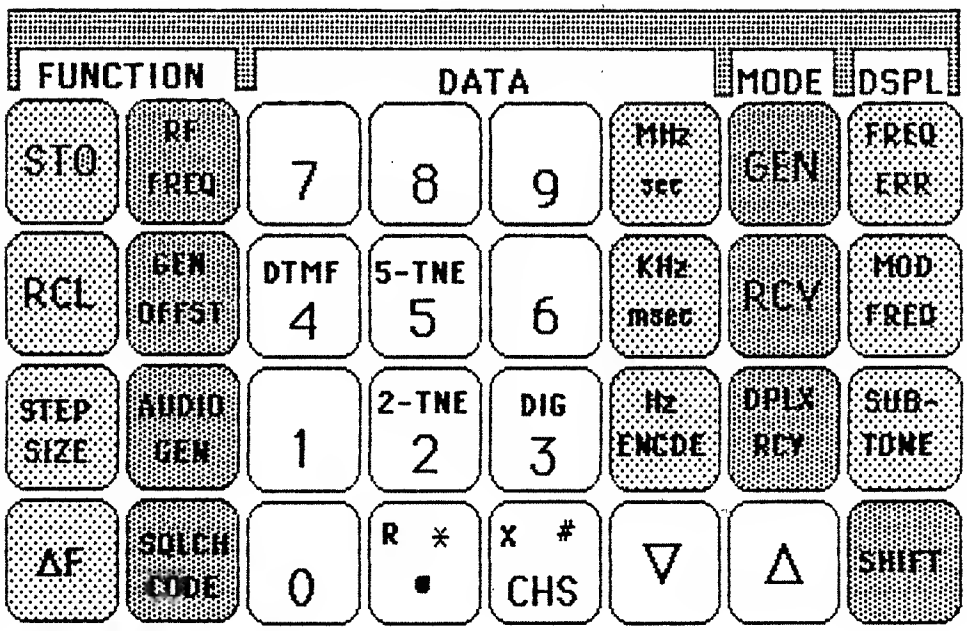


SECTION 4

OPERATION

4.1 USING THE KEYBOARD

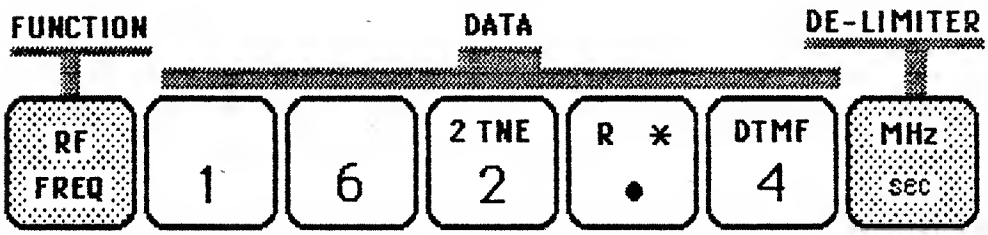
The keyboard is arranged in four sections. Reading from left to right they are: FUNCTION, DATA, MODE, and DISPLAY. Generally, an entry will be made in the same fashion: first selecting a function, then entering data or selecting a mode or a display. The DATA section is arranged in the manner of a standard calculator keyboard, with data keys, decimal, and de-limiter keys. Entry of numerical data must be followed by a de-limiter so that the processor knows that the sequence of numbers is complete, and may be acted upon.



With the use of de-limiters to tell the processor when the entry is complete, there is no need to enter leading or trailing zeros. Also, since the data is not acted upon until it is complete, incorrect entrys may be erased by simply re-selecting the function, and re-entering the data.

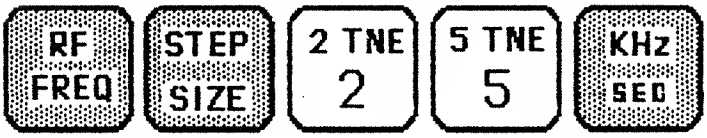
The following examples of typical operations will explain the general use of the keyboard. First select the function you want, then enter the data, and last, enter the delimiter.

To set the RF Frequency to 162.4 MHz,
perform the following keystrokes:

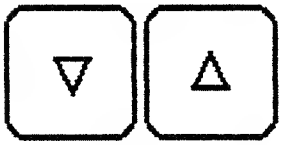


The RF Frequency may be programed to be stepped in increments of your choice (channel spacings, for example).

To set the RF Frequency Step Size,
perform the following keystrokes:

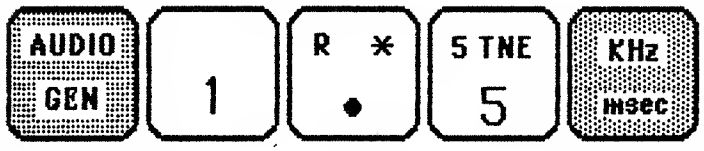


Now the up/down keys may be used to step the RF Frequency in 25 KHz increments. A single depression of the key will move the frequency 25 KHz. Holding the key down will produce consecutive 25 KHz increments at a rate of 10 per second.



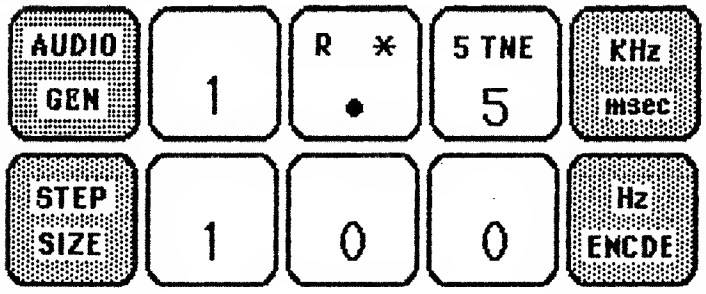
In the same manner, the **AUDIO GEN** function may be programmed for a selected audio frequency.

To set the AUDIO GEN to a frequency of 1.5 KHz,
perform the following keystrokes:



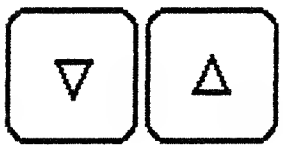
The AUDIO GEN function may also be programmed for steps of change in audio frequency.

To set an audio step size of 100 Hz,
perform these keystrokes:



Note that if the last item entered was an audio frequency, the step size entry need not be preceeded by the AUDIO GEN keystroke. The same is true of RF STEP SIZE, or any other data entry. The microprocessor will recognize the data as belonging to the last selected FUNCTION.

As with the RF steps now the Audio Frequency may be incremented with the up/down keys in 100 Hz steps.

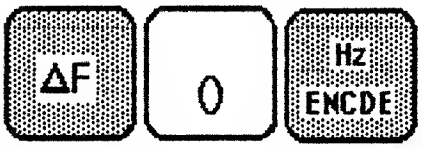


To "Fine tune" The RF frequency by ± 100 Hz steps, use the following keys:

After the ΔF key is pressed, the up key and the down key can used alternately to "rock" the RF frequency about the selected center frequency. *Note that a small annunciator at the right-center of the display shows the operator when the frequency is tuned off center -- even if another function has been called up.*

Holding either the up key or the down key depressed will provide continuous tuning, in 10 KHz steps.

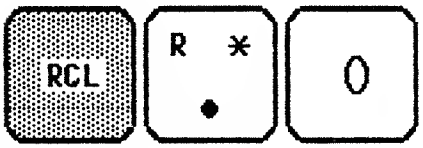
To quickly return to the center frequency, enter:



The STO and RCL functions will store or recall an entire keyboard setup. For example, in one memory location, the user can store an RF Frequency, an RF STEP SIZE, an AUDIO Frequency, an AUDIO STEP SIZE, a MODE selection (GEN, RCV, DPLX/RCV), and a DSPL selection (FREQ ERR, etc.). The twenty memory locations are numbered 0 thru 9, and .0 thru .9.

To store the current setup in memory location 8, perform the following keystrokes:

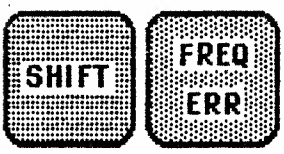
To Recall the setup stored in location .0,
perform the following keystrokes:



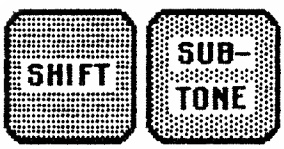
Some keys have a second function. In order to access the second function press the SHIFT key in the lower right hand corner of the keyboard, then press the desired key.

To obtain a display of Frequency Error,
press the FREQ ERR key.

To obtain a bar graph display of Frequency Error,
press SHIFT, FREQ ERR.

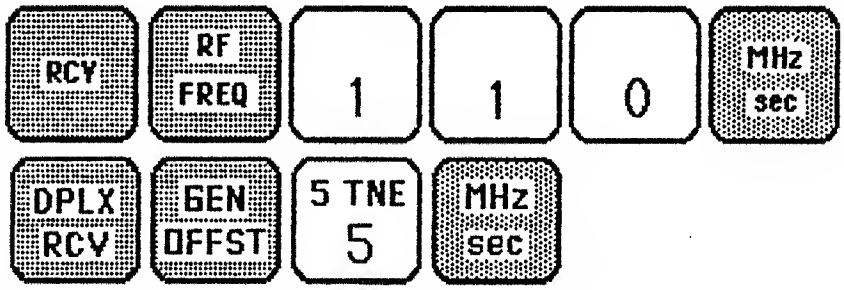


Another example of a Shift-Function: **SHIFT-SUB-TONE** automatically displays decoded digital squelch codes, both normal and inverted.



GEN OFFST sets the generator offset frequency for duplex operation. **NOTE:** To set an offset frequency, the instrument must be in DPLX/RCV mode.

First set the receive frequency, 110 MHz for example, then select DPLX/RCV, GEN OFFST, and enter, for instance, 5 MHz.



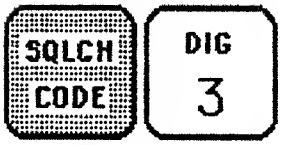
When an offset other than 0 Hz has been entered, a small GEN OFFST annunciator at the right center of the display will indicate that the generate frequency is offset even though another function may have been called up in the lower left portion of the display.

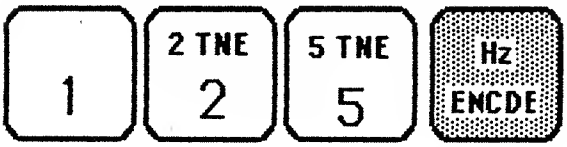
To set the generator for a -5 MHz offset, use the CHS (change sign) key after entering the offset.

SQLCH CODE selects a menu of special signaling functions; 2 TONE, 5/6 TONE, DTMF, or DIG. When the SQLCH CODE key is pressed, the LCD display will prompt "FORMAT-". Select a format by pressing the appropriate blue-lettered key in the data section.

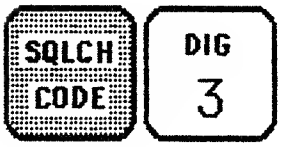
To use the DIG mode select SQLCH CODE, DIG, enter the code, and press ENCODE. To enter an inverted code, press CHS after entering the code. If the AUDIO/CODE LVL is set on **CONT**, the generator will continously repeat the code. If **BURST** is used, each push of the button will send the code once. **NOTE**: *The microprocessor will only accept valid digital codes. It will ignore all non-valid codes.*

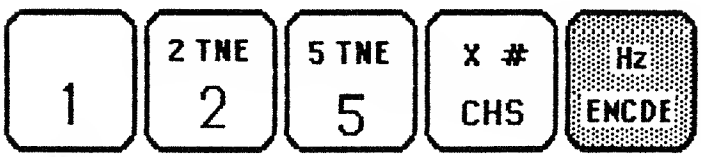
For a digital code of 125:



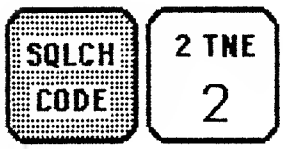


For a digital code of -125:



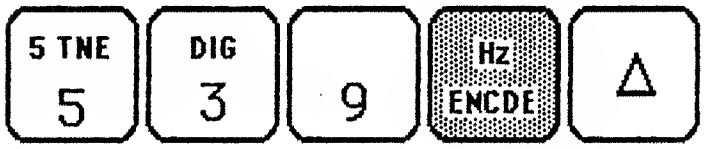


To set up a Two Tone Sequential signal,
press the SQLCH CODE button, then select the **Format** desired.

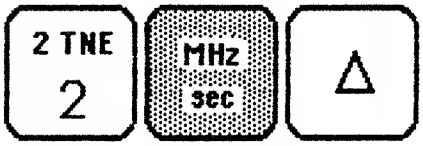


For example, Tone. Suppose that you want to set up a signal of 539 Hz (Tone A) for 2 seconds, followed after a delay of 3 milliseconds by 832.5 Hz (Tone B) for 1 second, followed by a delay of 1 second. Proceed as follows:

Enter the **frequency** for the first tone (Tone A) of 539 Hz:

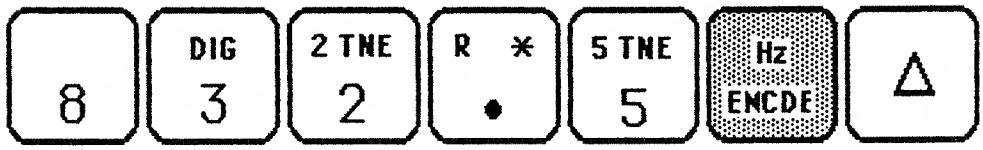


The up/down keys are used to scroll thru the entries for review or editing. By hitting the Up Key you can scroll to the next entry for review or editing. The next entry is for **Duration** so enter 2 seconds and scroll to the next entry:

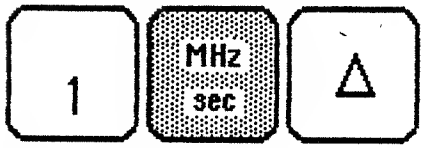


Now enter the **Delay** of 3 msec. following Tone A:

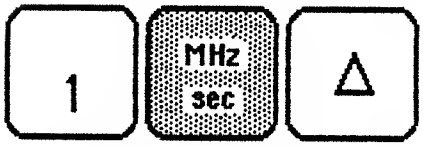
Next, enter the **Frequency** of the second tone (Tone B), 832.5 Hz:



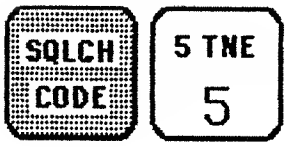
Enter the **Duration** of 1 second for Tone B:



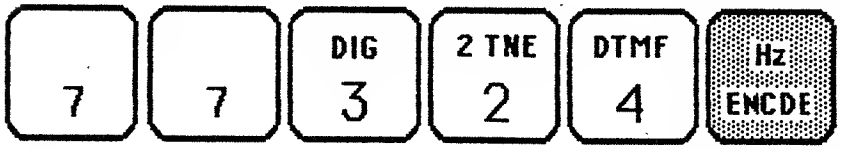
Enter the **Delay** of 1 second following Tone B:



Now set the **AUDIO/CODE LVL** to CONT or BURST with the buttons in the modulation section below the keyboard. **CONT** will produce a repeating sequence of the tones, while **BURST** will produce a single sequence of the tones each time it is pressed.



To send a 5-TONE signal code of 77324,
select SQLCH CODE and the 5-TNE Format. Then enter the data and press **Encode.**

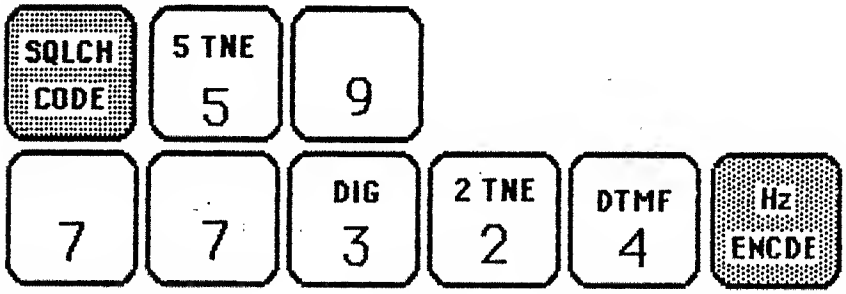


The microprocessor will determine by the number of data digits entered whether or not a preamble, or special postamble tone, is to be sent. If five digits are entered, it will send a standard five tone signal.

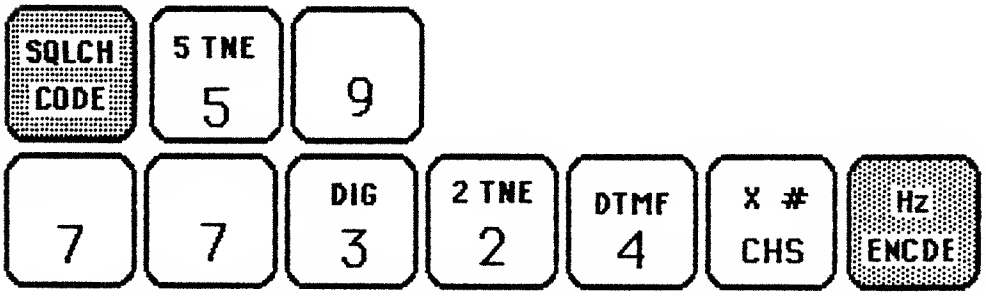
If six digits are entered, it will send a five tone signal with the preamble, with the first digit entered being the preamble. The display will show P + 5.

If seven digits are entered, it will send a five tone signal with preamble and postamble. The first digit entered will be the preamble and the seventh digit will be the postamble. The display will show P + 6.

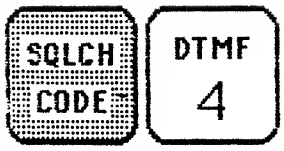
For a 5-Tone Preamble of 9 and an address of 77324, perform the following keystrokes:



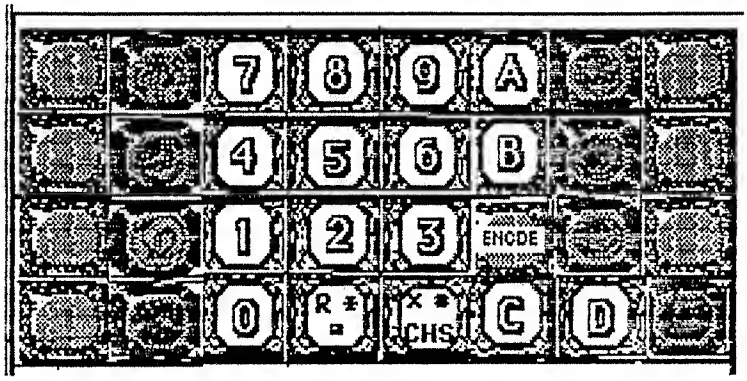
For a 5-Tone Preamble of 9, a Postamble of X, and an address of 77324, perform the following keystrokes:



There is no need to insert an "R" after repeated tones. If the AUDIO/CODE LVL control is set on **CONT**, the five tone code will be repeated continuously. If the **BURST** button is used, one sequence of the code will be generated for each push of the button.



To use the DTMF mode, select SQLCH CODE, DTMF. The display will prompt DTMF. Simply press the keys for the desired number to be sent, finishing with **encode**. Select **CONT** for a repeating sequence of numbers, or **BURST** for a single transmission of the numbers. To provide a full sixteen-key keypad, the processor uses the following keys: **MHz = A, KHz = B, Down = C, Up = D.**



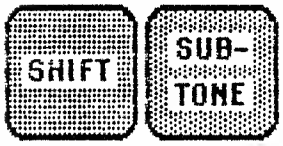
To use a DTMF code of 4523ACD9,
press the following keys:

SQLCH CODE, DTMF, 4, 5, 2, 3, MHz, Down, Up, 9, ENCDE.

The MOD FREQ mode selects a frequency count of modulation tones between 10 Hz and 19.999 KHz. It operates only in RCV or DPLX/RCV modes. The counter displays frequencies to 1 Hz resolution. To use this function, press the MOD FREQ button.

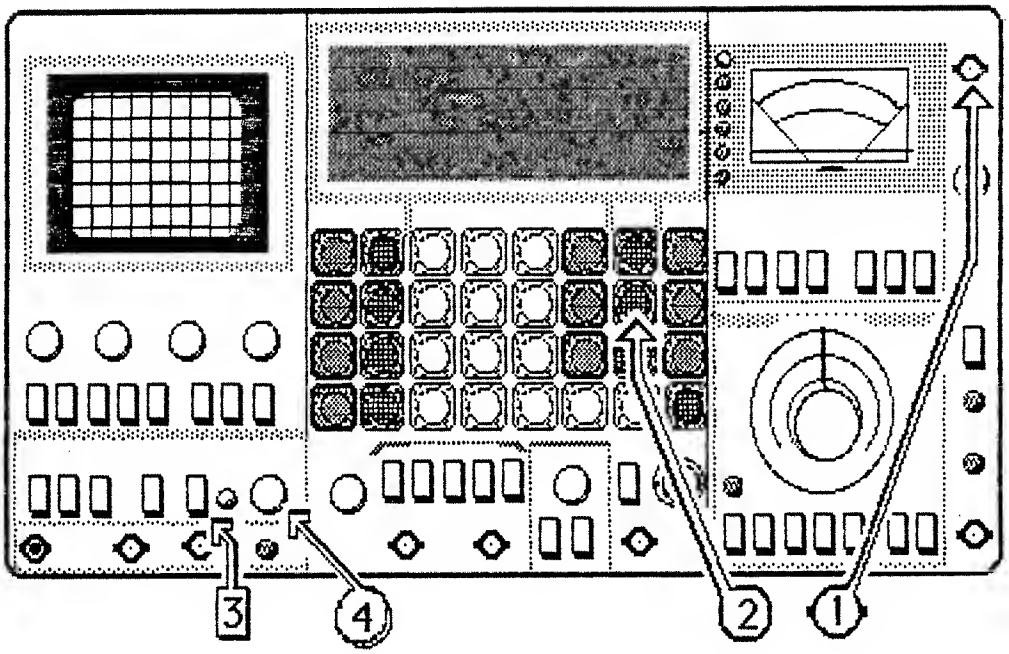
The VOLTS mode allows the meter (true RMS) and the CRTto measure signals at the external input. The display will show the modulation frequency and the speaker allows the audible sound to be monitored.

The SUB-TONE mode allows counting of sub-audible tones to 0.1 Hz resolution. It is filtered to count only frequencies between 50 Hz and 270 Hz. Therefore, it will accurately count the sub-audible tones in the presence of voice or other modulation. It operates only in RCV or DPLX/RCV modes. To use the function press SUB-TONE.



To decode DIG squelch codes, use SHIFT, SUB-TONE. The monitor will automatically display both a received normal code, and its inverted code complement. DIG squelch decode operates only in the RCV or DPLX/RCV modes.

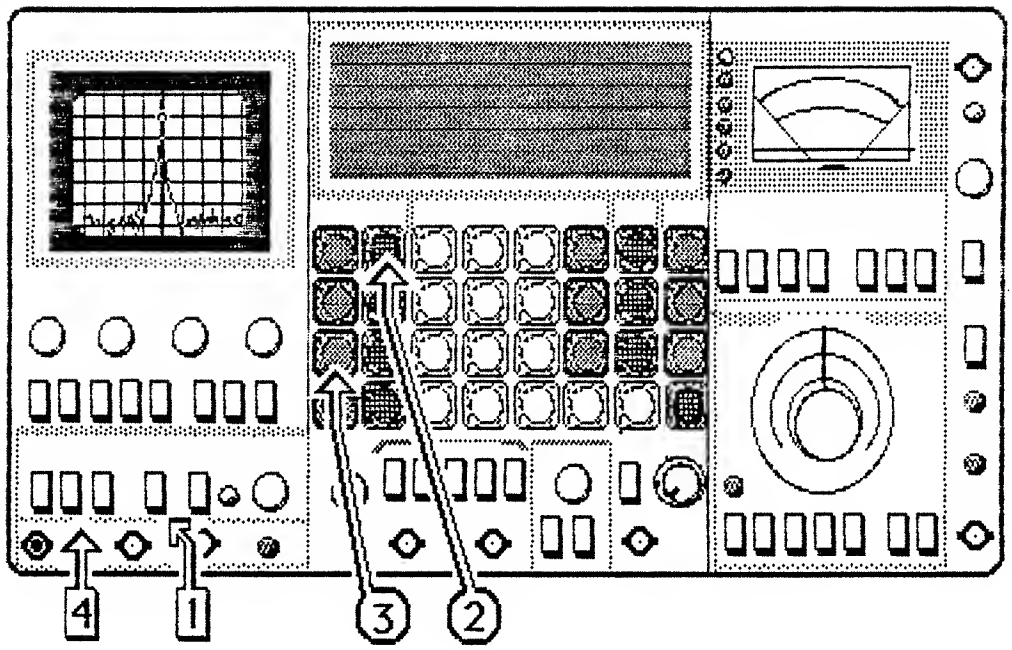
4.3 USING THE MONITOR



4.3.1 USING THE SPECTRUM ANALYZER

1., 2., 3. To operate the Spectrum Analyzer, connect the antenna to the antenna input at the upper right corner of the monitor, select **RCV**, and depress the **SCAN ON** button in the oscilloscope section. The oscilloscope will show a spectrum display.

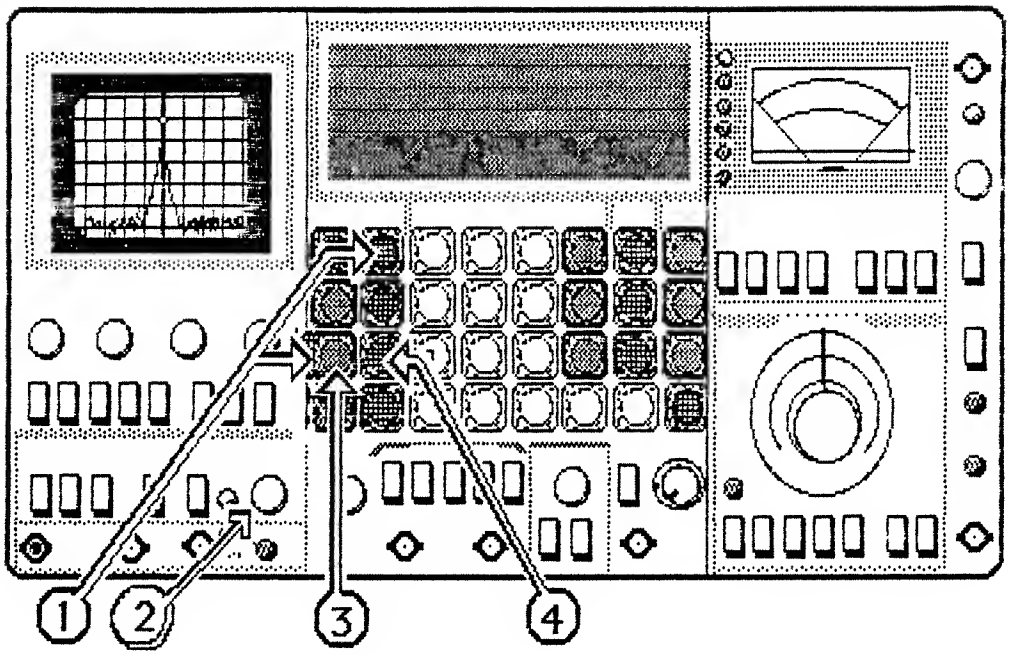
4. The size of the window being observed is controlled by the **FREQ SPAN** control (4), just to the right of the SCAN mode **ON** button (3). The minimum window is ≈ 500 KHz, or 50 KHz/div, and the maximum window is ≈10 MHz, or 1 MHz/div.



1. To eliminate the need of an exact centering of the horizontal position control to determine the frequency of observed signals, the **MARKER** function (1) will produce an intensified spot on the display at the selected RF Frequency.

2., 3. To determine the frequency of any observed signal, use the **RF FREQ (2), STEP SIZE (3)** and **UP/DOWN** buttons to scan the frequency until the marker rides on top of the signal of interest. Then read the center frequency from the LCD display.

4. The Spectrum Analyzer display has a 70 dB log range, and two 20 dB attenuators (4), to provide 110 dB of usable dynamic range. The maximum signal amplitude is +10 dBm, with the REF LVL "10 dBm" selected, and the minimum signal amplitude is -100 dBm with the REF LVL "-30 dBm" selected. A signal amplitude of -40 dBm would be on the -10 line with REF LVL -30 dBm selected, on the -30 line with REF LVL -10 dBm selected or on the -50 line with REF LVL 10 dBm selected.

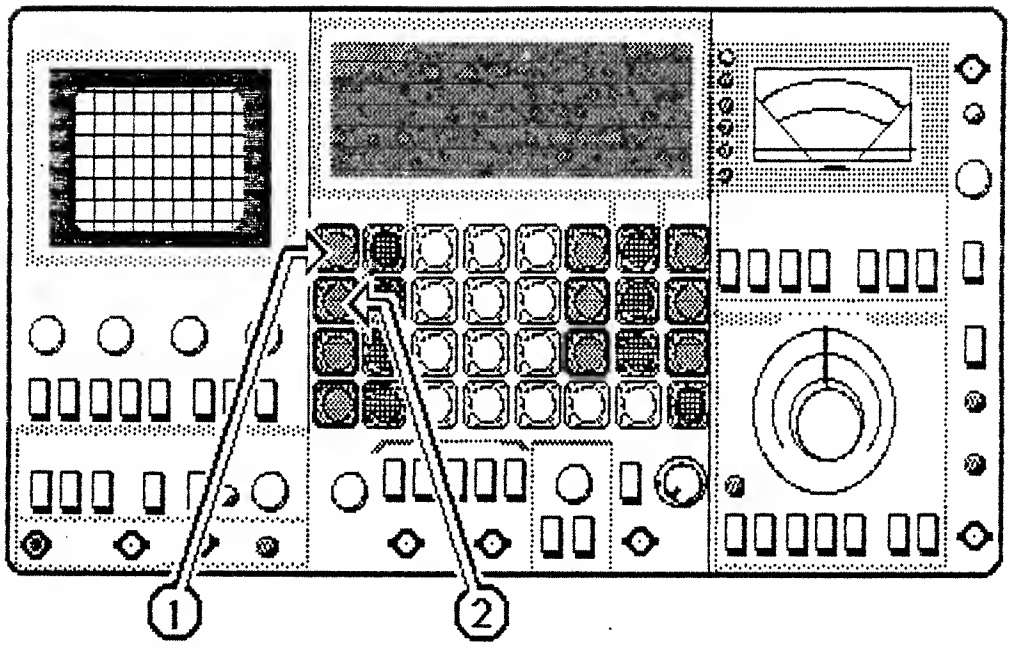


4.3.2 MAKING USE OF THE PROCESSOR

1. & 2. The processor provides several versatile capabilities which can ease test operations. One of these is the **STEP SIZE** function. The RF steps may be used **to calibrate the Spectrum Analyzer display to any desired horizontal dispersion.** Set the RF STEP SIZE to the desired dispersion per division, locate a signal on the display, step the frequency and adjust the **FREQ SPAN** control until one step equals one division (or 4 steps = 4 divisions for greater accuracy).

3. **To check harmonics** on a signal, a step size equivalent to the transmitter frequency may be set. The display would then show the second harmonic with one step and the third harmonic with an additional step.

4. The AUDIO GEN may be used as an **audio sweep generator** by programming a small AUDIO GEN STEP SIZE such as 20 Hz, and pressing the up or down button to produce rapid consecutive steps. The small steps at ten per second will appear as an audio sweep.



4.3.3 STORE and RECALL

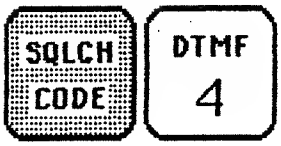
1. **STO.** The non-volatile memory allows storage of various configurations used on the monitor. For example, you could **store** customer configurations: a frequency, a generator offset, a channel spacing (RF STEP SIZE), and a sub-audible tone used by a particular customer. For example, if you had these parameters punched in:

   Fr frequency: 153.62 MHz; Generator offset: 5 MHz; Step size: 30KHz; (channel spacing); Sub-tone: 136.4 Hz,

   you could press STO, and then 8. That would put all this information in memory location 8.

2. **RCL.** Then you can **recall** the whole set of parameters at the touch of a button. In this manner, up to twenty separate customer configurations could be available at the touch of a button. For example, you could retrieve the setup shown above by pressing RCL, and then 8.

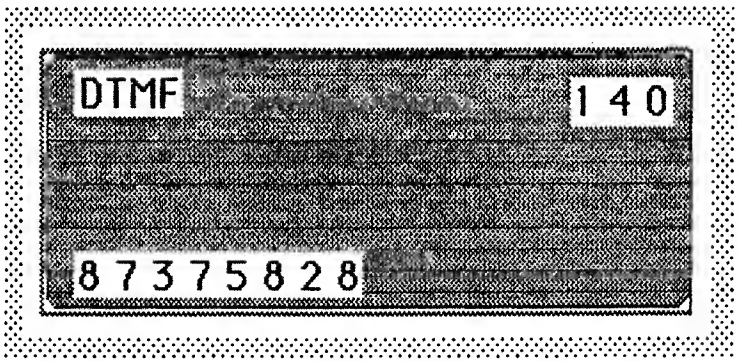
4.3.4 SENDING A PHONE NUMBER



1. You can send a phone number (up to 11 digits) by using the **DTMF** format. Press the **SQLCH CODE** button. The LCD display will prompt: "FORMAT-".

2. Answer the prompt by pressing the **DTMF** button.

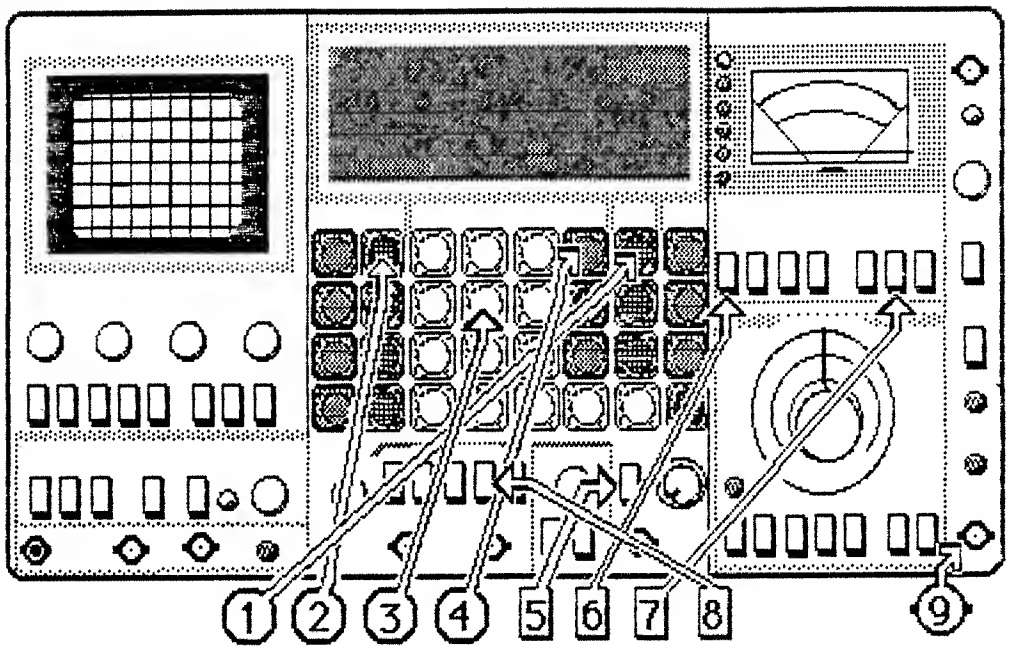
3. Enter the DTMF code and then press the "Encode" button. Since the number of digits is greater than 8, the first three digits will show at the top right of the LCD panel, and the following digits will display at the bottom left. Enter the DTMF code without gaps or dashes and press ENCDE. The number: **1-408-737-5828** would display as shown:



4. Pressing the **BURST** button will send the code sequence once, each time you press it.

5. If you press the **CONT** button, the code sequence will be sent continuously, with about a 2-second pause after the number.

4.4 APPLICATIONS



4.4.1 FM RECEIVER SENSITIVITY

1. Select **GEN.**

2. Select **RF FREQ.**

3. Enter the frequency of the receiver under test (e.g. 153.72 MHz).

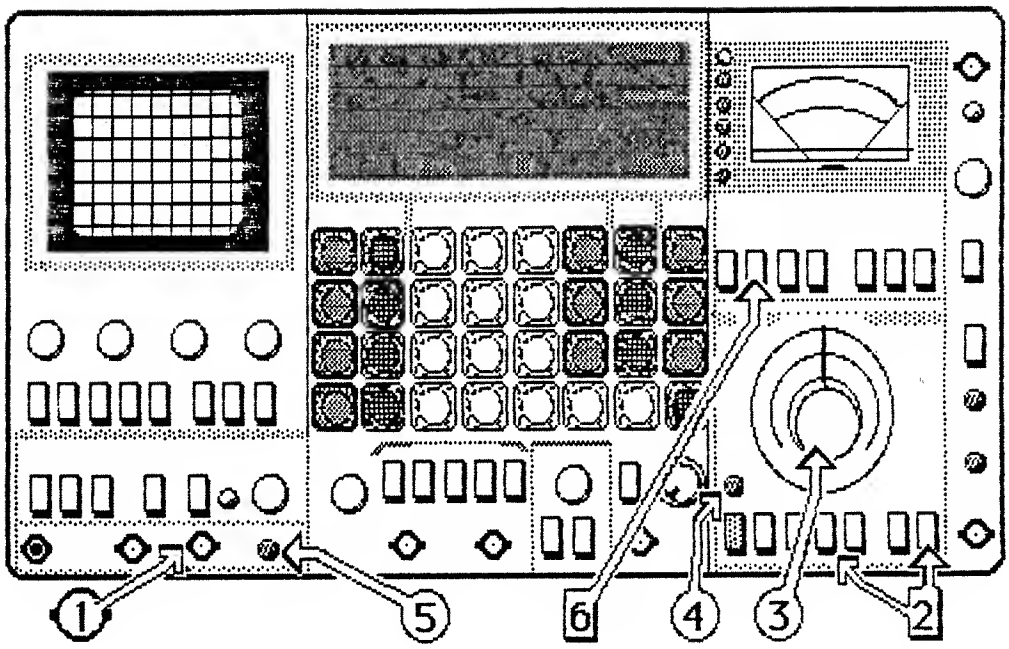
4. When the digits of the frequency have been entered, select the delimiter (in this case MHz).

5. Select the fixed **1 KHz** by depressing the button in the modulation section below the keyboard.

6. and 7. Select **MOD,** and **RANGE 6** in the meter section.

8. Select **FM** in the MOD section, and adjust the level of the 1KHz tone to 3 KHz deviation as read on the meter.

9. Connect the **RF IN/OUT** connector to the antenna connector of the receiver under test.



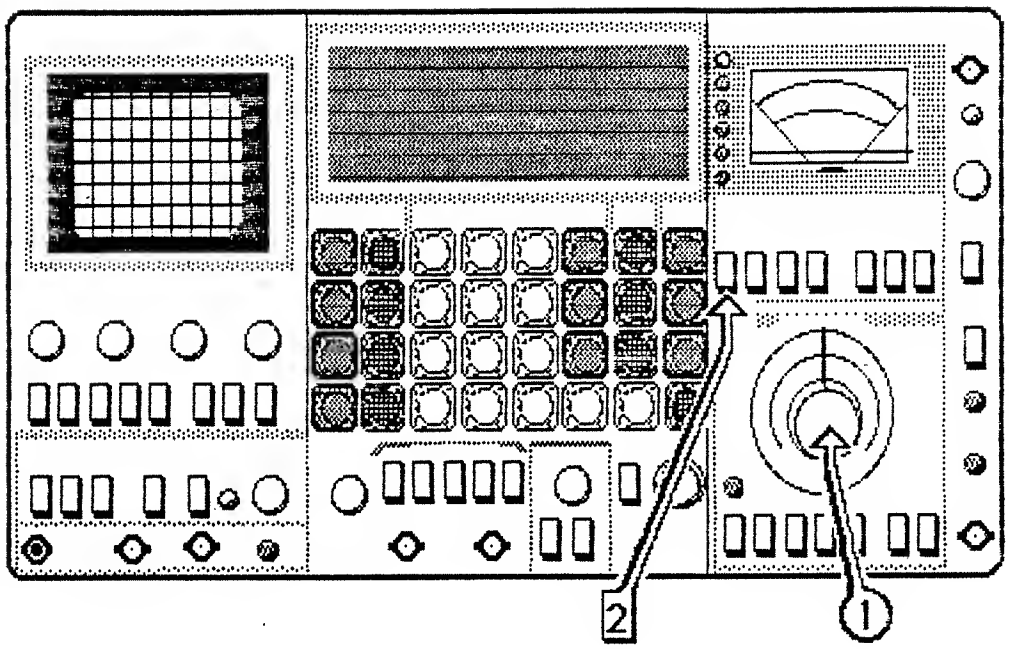
1. Connect the audio output (across speaker terminals) to the **EXT VERT** connector below the oscilloscope section.

2. & 3. Using the µV and X10 buttons and the vernier control, set the RF output level to ≈ 10 µV.

4. Make sure the **RF OFF LED** is extinguished.

5. Unsquelch the receiver and adjust the receiver volume control until the **SINAD LED** next to the EXT VERT connector is lighted.

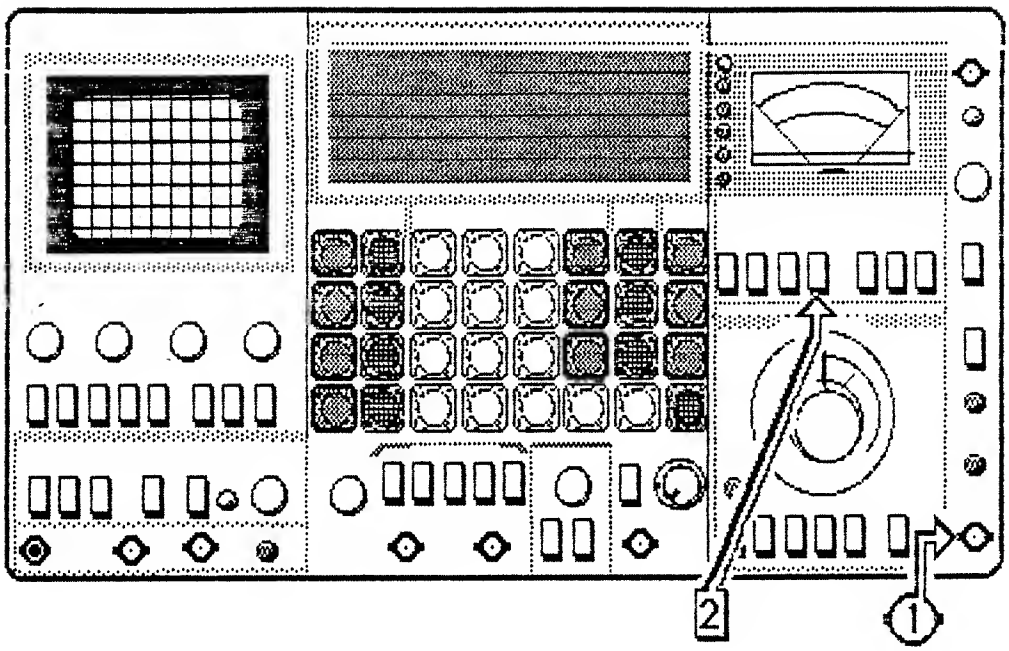
6. Now select **SINAD** in the meter section and, using the RF control and the attenuators, reduce the RF level until the meter needle comes up to the 12 dB mark. Read the sensitivity in µV using the outer scale of the vernier control along with the attenuator scale factors (X0.1, X1, etc.).



4.4.2 MODULATION ACCEPTANCE BANDWIDTH

1. From the SINAD sensitivity point (see section 4.4.1), increase the RF level by 6 dB. Increase the modulation deviation until the SINAD meter again reads 12 dB.

2. Select **MOD** in the meter section and read the Minimum Acceptance Bandwidth in KHz from the meter. Select RANGE X18 if necessary.



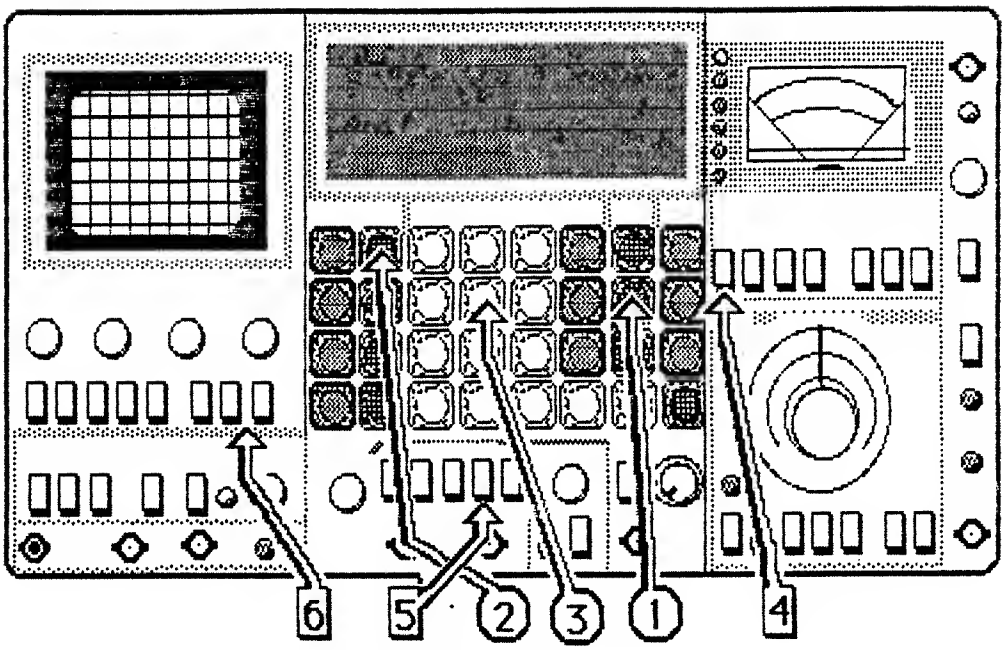
4.4.3 TRANSMITTER OUTPUT POWER

1. Connect the tranciever antenna connector directly to the RF IN/OUT connector of the monitor.

2. Select WATTS, and an appropriate range (15 or 150) in the meter section. Key the transmitter, and read the power output directly on the meter.

CAUTION: 150 W MAXIMUM!

The monitor will absorb 150 Watts for ≈ one minute or 100 Watts for ≈ three minutes. When the load reaches a temperature of 100°C, the LOAD OVERTEMP indicator will light, and an audible alarm will sound. Unkey the transmitter and allow the load to cool for a few minutes.

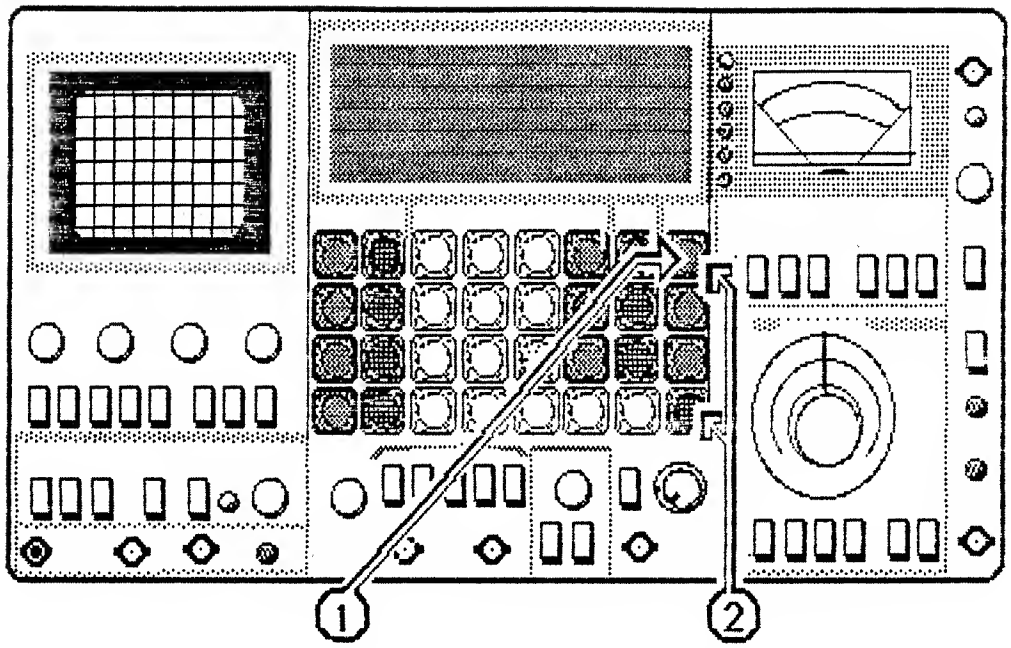


4.4.4. TRANSMITTER MODULATION

1. & 2. & 3. To monitor the transmitter modulation, the monitor must be set to the transmitter frequency. Set the frequency by pressing **RCV**, **RF FREQ**, and enter the data (e.g. 1 5 8 . 7 2 MHz).

4. & 5. Select **MOD** in the meter section, and **FM** in the modulation section, and key the transmitter. *If the transmitter under test has an output power of less than 10 watts, an antenna should be connected to the antenna input to ensure adequate received level.* The meter will display deviation, and the oscilloscope will display the audio signal. Note that the oscilloscope is also a peak-reading indicator, and modulation may be read directly from the graticule markings if the **VERT VAR** control is in its CAL (fully CW) position.

6. To aid in testing, built in FM CAL markers for ±5 khz or ±600 Hz may be added to the oscilloscope display in FM mode. The accuracy of the FM CAL markers will not be affected by the VERT VAR control. Reading the frequency of any modulation tone, or decode of DIG squelch may be accomplished by selecting the appropriate DSPL mode as described in Section 4.2.

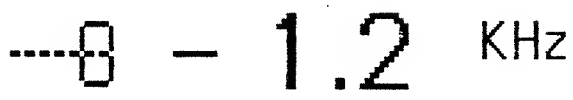


4.4.5 TRANSMITTER FREQUENCY ADJUSTMENT

1. To read the transmitter frequency error, select **FREQ ERR** in the DSPL section of the keyboard. The display will show the difference between the transmitter frequency and that of the monitor.

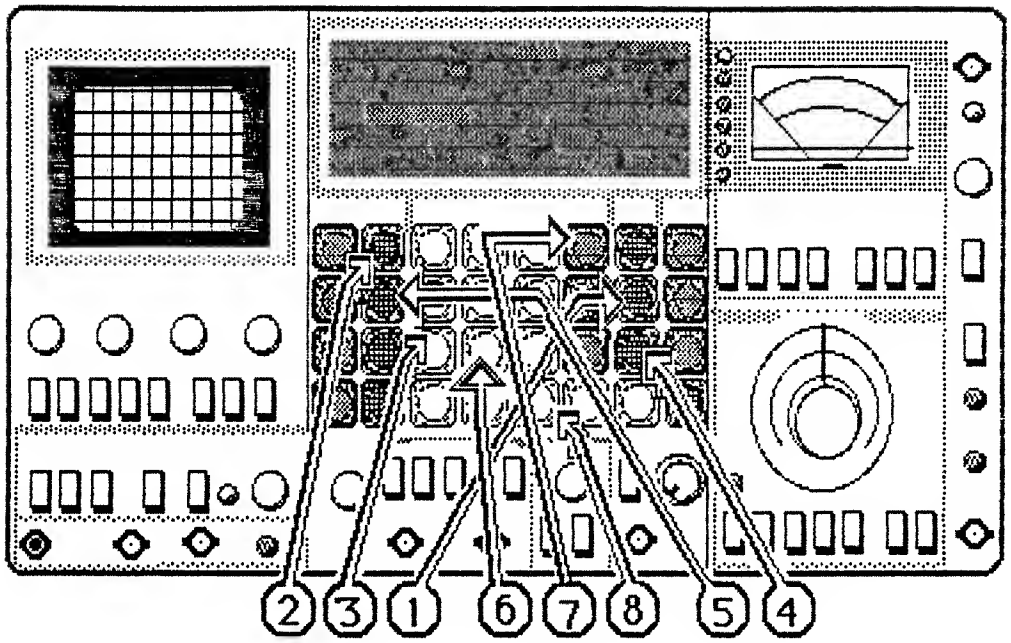
2. If a bar graph display of frequency error is desired, select **SHIFT, FREQ ERR.** The lower left section of the display will show a figure eight with an horizontal line extending from it. It's length and direction are proportional to the frequency error.

SHIFT, FREQ ERR will produce a display like this:



In the above example, the transnitter frequency is below the desired frequency. Whether or not the bar graph is selected, the frequency error will initially be displayed to 10 Hz resolution. If the error is less than 100 Hz for five seconds, the counter will auto range to the 1 Hz resolution mode.

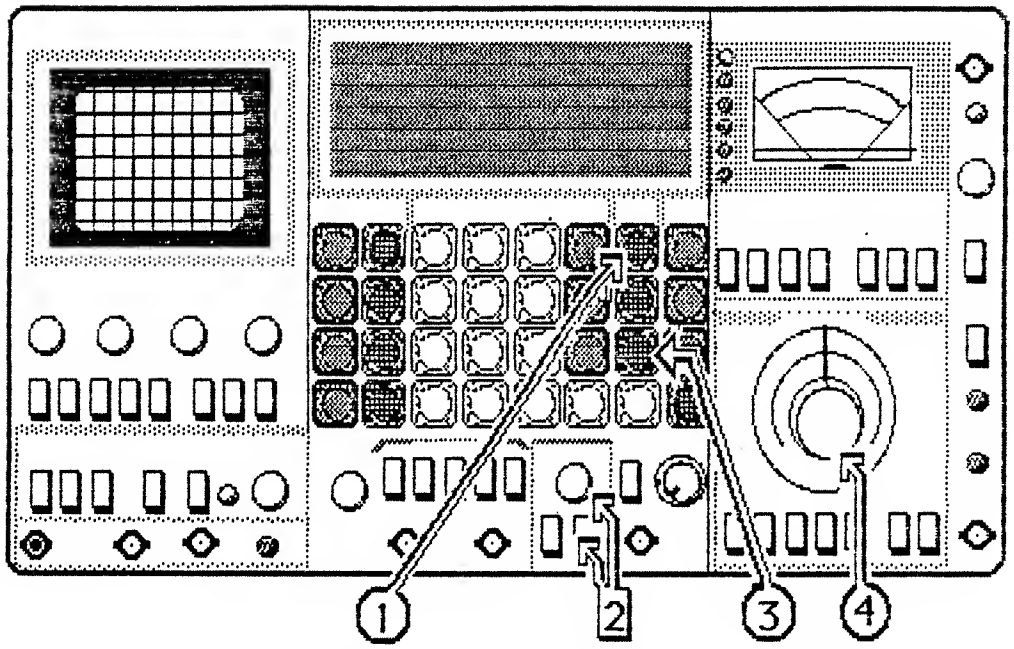
If an audible indication of frequency error is desired, the **SSB mode** in the modulation section may be selected to produce a Zero Beat.



4.4.6 REPEATER DE-SENSE

1. to 3. To test a repeater's receiver de-sense, first set up the monitor to receive the transmitter's frequency. Select **RCV**, **RF FREQ**, and enter the **data** (e.g. 1 5 8 . 7 2 MHz).

4. to 8. Then set up the generator for the proper offset (e.g. -5MHz) by selecting **DUPLX/RCV**, **GEN OFFST**, then entering the offset: (e.g. **5 MHz CHS**).



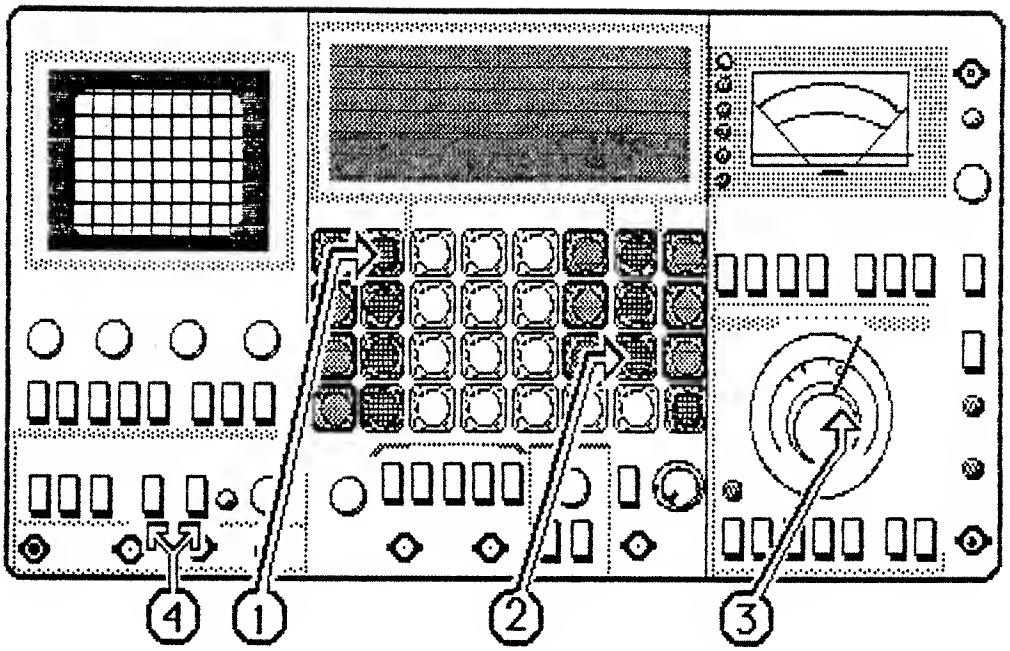
1. If tone or digital codes are required to break the receiver's squelch, select **GEN.**

2. Select the required tone function, and then using the **AUDIO/CODE LVL** and **CONT** controls, set the deviation.

3. Then return to **DUPLX/RCV** ,

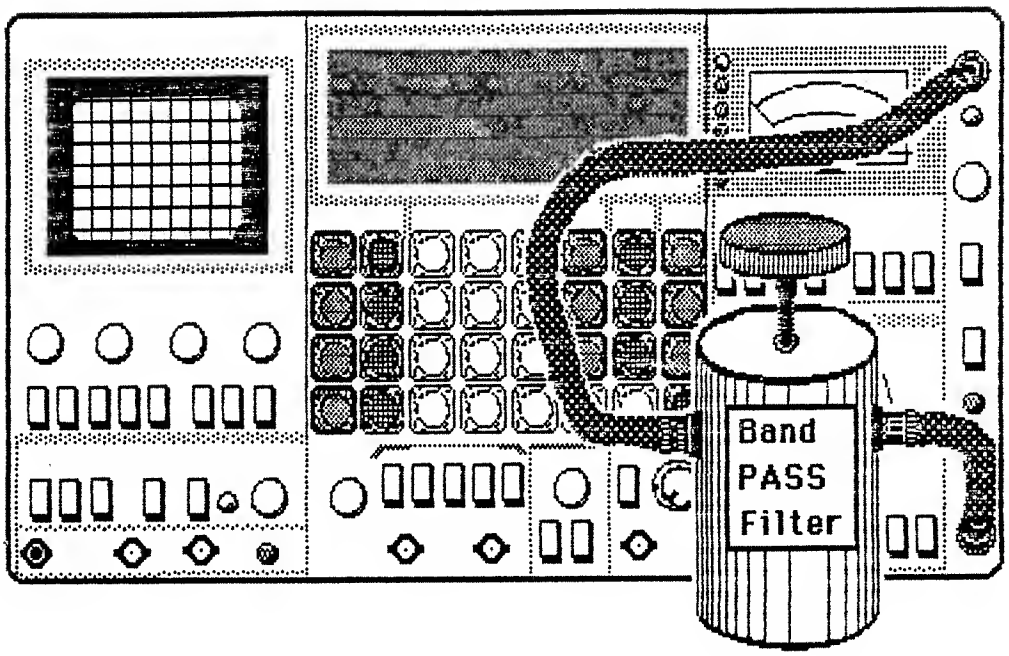
4. And connect the **RF IN/OUT** connector to the repeater antenna connector. Start with a low RF level out of the generator, increasing it gradually until the repeater keys up. Note the RF level in dB. If the repeater receiver is being de-sensed, the transmitter will key on and off. Gradually increase the RF level until the repeater transmitter stays on. Read the vernier dial in dB to determine how much the repeater receiver was de-sensing.

NOTE When the repeater keys up, the red **RVS PWR µV** indicator will illuminate to indicate that RF output is limited to the µVolt ranges regardless of where the mV/µV buttons are set.



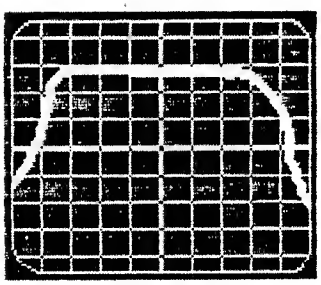
4.4.7 TUNING A BAND REJECT FILTER

1. Set the desired frequency.
2. Set the monitor for **DPLX/RCV** , 0 MHz GENERATOR OFFSET.
3. Set the RF LEVEL to **0 dBm** (mV x100)
4. Set the scope display for **SCAN ON, MARKER** .

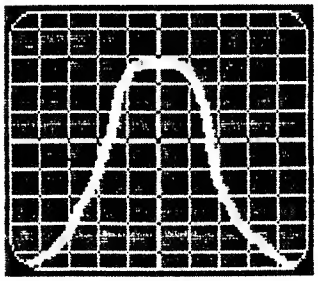


5. Connect a **BANDPASS** filter between the RF IN/OUT and the antenna connector.

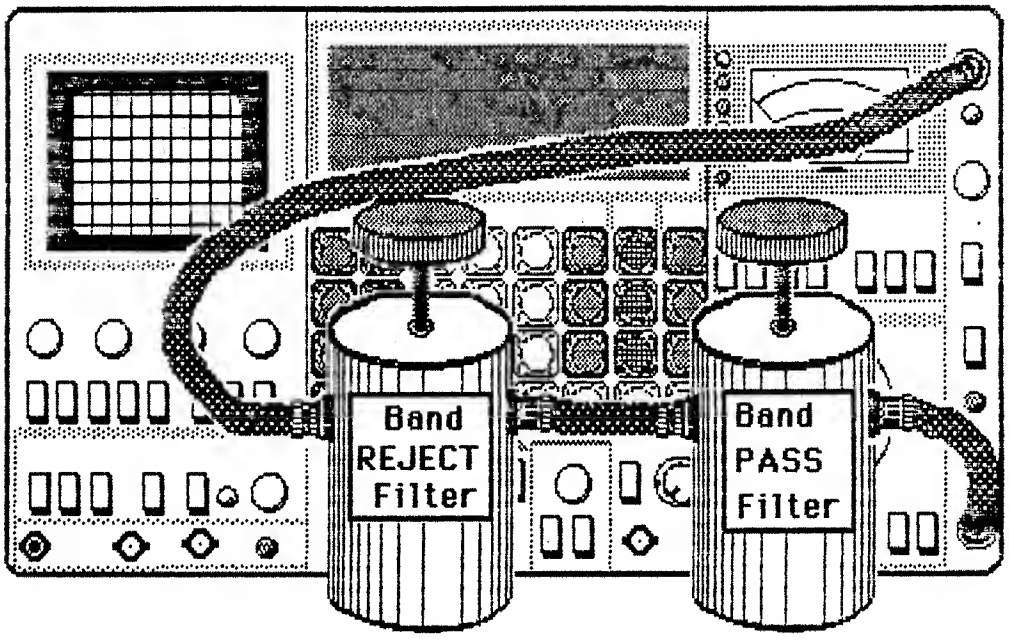
6. Tune the bandpass filter for a maximum level at the desired frequency (MARKER). Use the RF LVL attenuators as necessary.



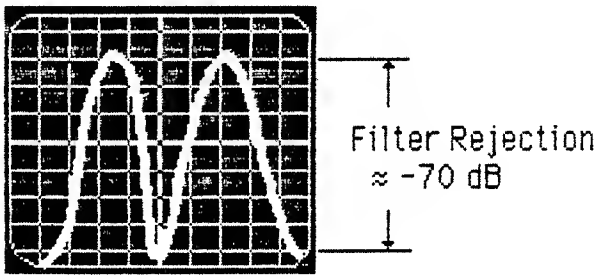
7. Narrow the scan width and use the RF LEVEL to set a convenient reference on the scope display.



8. Insert the band reject filter in series with the bandpass filter and tune for a minimum amplitude at the marker.



9. Measure the filter rejection in dB on the scope display.



MODEL 3100 QUICK REFERENCE GUIDE Version 1.3

OPERATION	KEYSTROKES	DISPLAY	SPECIAL NOTES
To set RF Frequency to 162.4000MHz	RF Freq 1 6 2 . 4 MHz	162.4000 MHz	
To set RF Frequency Step Size to 25 kHz NOTE: Use the ▽ △ keys to change the RF Frequency	RF Freq Step Size 2 5 kHz	162.4000 MHz RF STEP 25kHz	It is not necessary to press the RF Freq key before the Step Size key if the previous entry was an RF Freq entry.
To set the Gen Offset** to +5Mhz NOTE: To change setting to -5.00 MHz, press CHS	Gen Offst 5 MHz	162.4000 MHz GEN OFST 5MHz	Must be in the DUPLEX/RCV mode.
To set the Gen Offset** Step Size to 10kHz NOTE: Use the ▽ △ keys to change the Gen Offset by the Offset step	Gen Offst Step Size 1 0 kHz	162.4000 MHz GEN OFST 5MHz	It is not necessary to press the Gen Offst key before the Step Size key if the previous entry was a Gen Offset entry.
To set the Audio Generator to 1.5 kHz	Audio Gen 1 . 5 kHz	162.4000 MHz AUDIO GN 1.5K	
To set the Audio Step Size to 100 Hz NOTE: Use the ▽ △ keys to change the audio generator by the audio step size	Audio Gen Step Size 1 0 0 Hz	162.4000 MHz AUDIO GN 1.5K	
To "Fine Tune" the ** RF Frequency by ±10.00kHz	ΔF ▽ △ ▽ to tune down, △ to tune up	162.4000 MHz ΔF 1.5kHz	Keeping the ▽ or △ key depressed will allow continuous tuning.
To set-up a 2-Tone signal with: Tone A: 1.000kHz Duration A: 1.0 sec Delay A: 3 msec Tone B: 2.000kHz Duration B: 2.0 sec Delay B: 1.0 sec	Sqlch Code 2 TNE 1 kHz △ 1 sec △ 3 msec △ 2 kHz △ 2 sec △ 1 sec	2 TONE DELAY B 1SEC	To review or edit entries, use the ▽ △ keys to "scroll" the entries.
To encode a Digital Code of 125 NOTE: To change code to 125 inverted, press CHS	Sqlch Code DIG 1 2 5 Encde	DIGITAL ENCODE 125	
To activate the DTMF signals: 1 2 A B C D	Sqlch Code DTMF 1 2 MHz KHz ▽ △ Encde	DTMF- 12ABCD	
To send a 5-Tone signal with Preamble and 6th Tone of 4 47732 X ↑ Preamble ↑ 6th-Tone	Sqlch Code 5 Tne 4 4 7 7 3 2 X Encde	P+6 TONE 447732X	There is no need to insert an "R" after a repeated tone # (ie. "77").

* Must be in the RCV or DUPLX/RCV mode.

** Must be in the DUPLX/RCV mode.

OPERATION	KEYSTROKES	DISPLAY	SPECIAL NOTES
To send a 5-Tone signal with Preamble only of 4 47732 (Preamble)	Sqlch Code, 5 Tne, 4, 4, 7, 7, 3, 2, Encde	P+5 TONE 447732	There is no need to insert an "R" after a repeated tone # (ie. "77").
To send a 5-Tone signal only of 47732	Sqlch Code, 5 Tne, 4, 7, 7, 3, 2, Encde	5 TONE 47732	There is no need to insert an "R" after a repeated tone # (ie. "77").
To Measure Frequency * Error NOTE: Display will automatically give 1 Hz resolution if the Freq Err is less than 100 Hz	Freq Err	162.4000 MHz FREQ ERR 1.5K	Must be in the RCV or DUPLEX/RCV mode.
To Measure Frequency * Error with a Bar-Graph Dispaly NOTE: Bar-Graph shows that the Freq Error is high	Shift, Freq Err	162.4000 MHz 0-----1.5K	Must be in the RCV or DUPLEX/RCV mode.
To Count Modulation * Frequency (To Count Subtone, use the Sub Tone key.)	Mod Freq	162.4000 MHz MOD FREQ 1.2K	Must be in the RCV or DUPLEX/RCV mode.
To Decode Digital* Coded Squelch	Shift, Sub Tone	162.4000 MHz DIG RCV 025	Must be in the RCV or DUPLEX/RCV mode. The display will alternate between 025 and its inverted code -047.
To Store an instrument setting into memory #3 (there are 20 possible locations, 0 - 9, and .0 - .9)	STO, 3	STO -	
To Recall an instrument setting from memory #3	RCL, 3	RCL -	

* Must be in the RCV or DUPLX/RCV mode.

** Must be in the DUPLX/RCV mode.

SECTION 5

THEORY OF OPERATION

5.1 OVERALL

The RF phase-lock loop on the A3 High Frequency Synthesizer board generates a frequency from 22 to 1022 MHz in 1MHz steps. In generate mode this is mixed with a 9 to 67 MHz (100 MHz steps) low frequency PLL on the A4 board to provide an output frequency of .4000 to 999.9999 MHz in 100 Hz steps.

In normal receive mode, the output of the A3 high frequency synthesizer is 22 MHz above the MHz digit on the frequency readout. It is mixed with the antenna input in the A1 receiver board and the 22 MHz product is then mixed with a 17.1 to 18.1 MHz phase-lock to generate a 3.9 MHz 2nd IF output. In reverse receive mode the A3 high frequency synthesizer shifts to 22 MHz below the MHz digit on the frequency readout and the A1 phase-lock shifts up to a 24.9 to 25.9 MHz range.

The 3.9 MHz 2nd IF is mixed with a 3.2 MHz reference in the A2 to yield 700 KHz. The 700 KHz signal drives the demodulation detection and circuits in the A2.

A detailed description of how each individual board functions follows.

5.2 A10 BOARD

The purpose of the A10 board is to control all the basic functions of the 3100 and to route the various signals in their respective paths. Almost all switching is done at board levels by solid-state analog switches. The front panel switches are used to control the solid-state switches.

In the generate mode, the A10 card has five input paths to modulate audio. The A5 audio synthesizer enters board pin 4, and goes to analog switch U14D. The A11 card sends digital squelch information in via board pin 18 to U14A. The chosen audio goes to the front panel "Code LVL" control, and returns via board pin 20 to one of the inputs of sum amplifier U2B. Other A10 board inputs to the sum amp are 1 KHz (pin 21) external mic in (pin 41), and external modulation in (pin 13). After passing through summing amp U2B, the audio is split four ways. It goes out to the front panel mod out jack (pin 12). If the MOD switch is activated, audio passes through switch U1A and goes to the front panel volume control via U11B. It also goes to buffer 12A and on to range switch U10 and buffer U3A to drive the scope and meter. The scope audio is sent off the board via buffer U4B. The meter path goes through lowpass filter U6, buffer U3B, and switch U8B to "meter in" board pin 33. The meter audio is processed on the A8 board, and returns to the A10 via "meter out" pin 38, passes through switch U9C, and goes to the meter protect circuit (Q3, 4). This circuit sinks current when the signal exceeds 1.5 times meter full scale. The meter signal goes on to the meter via board pin 23. When the unit is in AM generate, the audio leaving summing amp U2B is routed via switch U15D to the AM generate output (board pin 26). For FM or ØMod, audio goes through amp U2A. Since the modulator in the 3100 is a Ø modulator, U2 is basically a 1:1 amplifier in the Ø Mod position with switch U1B closed. When FM is chosen, U1C closes, and audio is given a 6 dB per octave roll-off to integrate the audio for FM. The audio passes through switch U15C to FM (+) pin 12 on the board. RF generate output level switching is done by S11 and S12. Other controls used in generate are microphone PTT (S10), scope sweep rate (S1, U16), and tone (cont/burst) (U15, 16).

In the receive mode, receive audio enters the board via pins 28 (AM/SSB) and 31 (FM/ØM). Switch U15A, and U15B choose which path is passed. the audio enters the ØMod filter (U11A) and switch U16C, or is by-passed through switch U16B. Audio is sent off the board to the F.P. volume control via U11B, and to buffer U12A.

Audio level is selected by range switch U10, buffered by U3A, and sent to the scope and meter circuits. Scope audio goes through the F.P. D.C./A.C. switch, is buffered by U4B, then leaves the board (pin 16). Meter audio goes through L.P. filter U6 which removes the marker chopping pulses from the receive audio. This is buffered by U3B, goes through switch U8B and leaves the board (pin 33). The audio is sent to the A8, and comes back to this board as it does in the generate mode. "Audio" and SINAD signals enter the A10 board via buffer U4A. Audio is sent out to the A5 SINAD circuitry by board pin 29. It also goes to switch U10C, which sends audio to the front panel volume control via U11B, and to buffer U12A. In the audio mode, audio goes through range switch U10 and then goes to the scope via U3A and U4B, while going to the meter via U3A, U5B, the A8 meter circuitry, U9C and out board pin 23. In the SINAD mode all range switches are open, and the audio

leaving board pin 29 goes through SINAD circuitry on the A5 and reenters the board via pin 30. This goes to the meter via U5C, while going to the scope via U5A, 3A and 4B. When the WATTS button is pushed, and the 3100 is being transmitted into, the D.C. voltages from the power detector circuit on the A4 generator board enter via A10 board pins 16 and 19. The range switch selects U9A or 9D, and routes this through U9B to the meter.

Other circuits used in the audio and receive modes are the marker circuit (S2, U8C, 8D), spectrum analyzer (S3-5, 13), receive bandwidth (S14), ext/lissajous (S1E, U16A, 16D), scope sweep rate (S1A-D), and tone control (S15, 16). The keypad is organized in a matrix of four rows and eight columns, and is scanned by the A11 processor board to detect any depresssed keys. When it does, it decodes the key and executes the needed functions.

5.3 A11 PROCESSOR BOARD

The A11 processor board accepts input from the front panel keypad, external keyboard connector, fault indication lines and other lines that monitor conditions in the instrument. This data is then processed and sent back to modules in the unit as control data, status indicators and display information.

The A11 board contains a real time counter used to determine frequency error, identify subtones and perform other similar functions. Besides these digitally based functions, the A11 contains a subtone multiplier, a low-pass digital filter and a battery back-up circuit for the RAM memory.

The digital circuitry is designed around a Motorola 68B09 microprocessor, which is an 8 bit micro with 16 address lines. The initial programming instructions are in a 16K ROM and user programmed settings and other selected data generated during the use of the instrument are stored in a 2K RAM chip.

The microprocessor communicates with other digital chips via multiple line "busses". An eight line data bus with lines marked D0 through D7 provides the microprocessor with instruction codes and data. The microprocessor also transmits over the lines to send data to RAM, latches and other chips. Transceiver chip U17 allows information to pass one direction into or out of the microprocessor data lines according to a high or low bit presented at the direction line (U17 pin 1). The transceiver may also be gated off (U17 pin 19) preventing any information from entering or leaving the microprocessor.

To prevent more than one chip from using the data bus at a time, all chips on the data bus are inhibited until they are selected or gated by a signal from the microprocessor via the Programmable Array Logic (PAL) chip (U1) or by chip select U33. Address lines A0 through A15 from the microprocessor spell out codes that enable RAM, ROM or specific I/O chips.

Latches U22 through U26 gate information out from the data bus to various indicators and control lines for programming level, band, frequency and other microprocessor controlled functions of the unit. Octal buffers U18, 19 and 20 input monitor fault lines from each module in the unit and some miscllaneous control lines.

The microprocessor reads this information at regular intervals in order to determine if a fault has occured.

The $\overline{\text{LCD BUSY}}$ line on U19 prevents the microprocessor from sending data to the A9 LCD driver ship if for any reason the A9 is not ready to receive data. A Peripheral Interface Adapter (PIA) U13 exists solely for the purpose of monitoring the A10 keypad and interrupting the microprocessor with updated settings as required. A sequential three bit code from U13 pins 10, 11 and 12 is converted into an eight line output by matrix chip U9. The eight lines go low one at a time scanning the columns on the keypad. At the same time, the PIA monitors each A10 keyboard row. The rows are all normally pulled high by resistors in RP2. If a button is pressed on the A10 keyboard matrix, it connects a row to

a column. As the column lines are being sequentially scanned by the matrix chip, it is only a matter of microseconds before a column line will scan the row line being intersected. Since the column number is indicated by the three bit code from U13 PB0-PB2 and the row number is indicated by a low at one of the lines U13 PB3-PB6, the identity of the bottom pressed can be determined when the microprocessor interrogates the PIA data bus.

Information being sent to the A9 display is presented on the data bus and gated through latch U25. The A9 display driver accepts serial data through the SI line (J2 pin 6). The data is synchronized via the SCK line (J2 pin 5).

U12 is a real time counter. Its frequency inputs are marked S1, 2 and 3. S3 is the input for counting modulation, S2 is for the subtone counting and S1 accepts accepts the 700 KHz IF for determining frequency error. A 1 MHz reference frequency for the counter is supplied by U8 which divides the 8 MHz reference from J4 by 8. When the selected input is counted, it is transformed into a eight bit word that is written onto the data bus when the write line (pin 9) is pulled low.

A subtone multiplier composed of U29 and U28 greatly reduces the time required to read low frequency subtones accurately. A subtone on J1 pin 22 between 50 and 270 Hz is converted to a TTL level by U30. U31 buffers the waveform and drives one input of phase locked loop U29. The output of the phase-lock is divided by ten by U28. The output of the divide by ten then feeds the other input of the phase-lock. As a result, the output of the phase-lock will always be ten times the frequency of the subtone. Moving the decimal point to the left one place now allows tenths of a Hertz to be read out in one second.

DPL codes that are read or generated by the microprocessor are clocked through flip flops U14, 15 and 16. The DPL code coming out of U14 pin 9 is not suitable for modulating the carrier because its sharp edges would cause unacceptable odd harmonics to be generated. A two pole lowpas filter consisting of U32 and associated circuitry rounds off the sharp edges and creates an acceptable waveform.

A battery backup circuit is composed of U5, 6, BT1 and associated circuitry. Comparator U6A monitors the five volt line and compares it to the voltage across C7 which is isolated from drops in the five volt line due to CR2. If the five volt line suddenly goes low for any reason, U6A pin 1 goes low and privents the selection of the RAM. It also triggers comparator U6B low which resets the microprocessor. In the meantime, the contents of RAM are preserved due to backup battery BT1 which holds up the RAM supply voltage through CR4.

During powerup, capacitor C9 holds the rest line low until it eventually charges up through R6. The inputs to comparator U6B during this time are irrevelant because the output at pin 1 is open collector.

Regulator U27, L1 and associated parts are fed from the unregulated five volt supply line of the unit to isolate digital noise from the RF circuitry in the unit.

U3 is a gate that is read during powerup only. It signals the microprocessor over the data lines that fault indicators selected by switch S1 are to be ignored. This is done primarily to keep the unit operational during trouble-shooting.

5.4 A3 HIGH FREQUENCY SYNTHESIZER

The A3 high frequency synthesizer board generates a frequency that ranges from 18 MHz to 1022 MHz. While it is phase-locked in 1 MHz increments it may also be swept up to a 10 MHz sweep width via an analog ramp voltage.

The heart of the high frequency synthesizer is a voltage controlled oscillator (VCO) adjustable between 240 MHz and 520 MHz. This frequency is divided or multiplied to obtain the programmed output. The VCO consists of Q2 and 3. Emitter coupling is through the series resonance of voltage variable capacitors CR1 and 2 and L7. U1 buffers the output.

The oscillator output then goes through divide-by-2 circuits U9 and 10 resulting in a 60 MHz to 130 MHz range presented at the input pin 9 of digital phase-locked loop synthesizer U16.

When the incoming frequency at this pin does not match the divide-by frequency, the output of U16 (pin 16) sinks or sources current and steers the VCO through loop filter U15 until the two frequencies match. When this occurs pin 16 stabilizes at 2.5 volts and the output of U15 is at ground.

This results in 2.5 volts at pin 4 and 7 of the lock comparator U20 which in turn switches control of the VCO loop over to a low noise sampling bridge via U14.

The sampling bridge consisting of diodes CR24, 25, 26 and 27 is used because it is quieter than the phase-locked synthesizer. The bridge is sampled by a 500 MHz squarewave through U8. Any imbalance in the bridge rectifies and charges C68. Buffer U7 then keeps the oscillator on frequency. Offset pot R91 is used to set the DC balance of the bridge. If the loop should start to unlock for any reason, U16 will sense the error in frequency and again take control of the loop until lock is achieved again.

A shaping circuit consisting of U12, diodes CR20-23 and associated circuitry corrects the oscillator drive voltage to accommodate the non-linear characteristics of the variable capacator diodes of the oscillator. Diode CR20-23 are biased so they change the feedback resistors of U12 according to the amplitude of the voltage pin 7. Two Zener diodes CR31 and 32 prevent the control voltage from ever exceeding the specified range of the oscillator diodes and causing damage or out-of-band oscillations to occur.

When the fundamental frequency of the oscillator (240 to 520 MHz) is required at the output of the module, the signal travels through RF amplifier U2 and 3 and then through pin diodes CR10 and 17 to the output connectors of the module J1.

When frequencies lower than 240 MHz are required, four divide-by-two circuits consisting of U9, 10 and 17 are used. In these cases CR3 and 5 are switched open by Q6 and 5 which in turn prevent the primary oscillator frequency from leaving the module. The appropriate divide-by circuit output is then switched through U11. The actual divide to be switched on is determined by control lines marked bands 1-6 which are controlled by the A11 processor board.

The divided output selected through U11 is then directed back to the RF output path of the module through CR8.

In order to cover the 520 to 1022 MHz range above the fundamental oscillator frequency, doubling is used. The doubler consists of T1, CR12-16, L13 and RF buffer amps U4 and 5. Pin diode CR10 and 17 shut off and the output of RF amplifier U3 is directed through CR11 to the doubler and back through CR18 to the RF output connector J1.

J2 is a second RF output used by the A4 module. It is padded by 14 dB. A level detection circuit is formed by CR19 and comparator U20. A loss of output from the A3 results in a high signal at Pin F.

When the instrument is in Scan, an analog ramp at module pin 5 drives amplifier U23B and its amplitude is adjusted by scan pot R164. In order to maintain a constant scanwidth in different bands, U21, 22 and 24 switch in an appropriate input resistor to amplifier U23.

The scan control line (module pin 3) serves two purposes. It switches the properly scaled scan voltage through U21 and it is also used to stop the scan ramp at mid-point to cause a short wait time on the ramp. This wait time is necessary to sync the oscillator to the "intensified spot" video marker used on the Comtest 3100 analyzer display. Precise positioning of this marker is adjusted by marker pot R106.

When the scan mode is deactivated, U6 switches in filter capacitor C60 to keep residual FM of the oscillator at a minimum.

5.5 A1 RECEIVER BOARD

The primary purpose of the A1 Receiver Board is to mix the antenna input with the output of the A3 RF synthesizer. The resulting 3.9 MHz IF signal is fed to the A2 IF amplifier board. The A1 also provides the 100 Hz frequency resolution steps not available from the A3 module, and sends a 238 KHz lock signal to the A4 generator board.

Diodes CR7, 8, 9 and 10 at J5 (antenna in) form an input limiter to provide some protection against the accidental application of high power levels of RF into this port. The signal then travels through two 20 dB attenuators (R131-136) that are selected on the front panel via U8, 9 and CR11-16. The attenuators are used in the scan mode to select the spectrum analyzer reference level. In other modes of operation the attenuators are automatically switched out of operation by the A10 module.

The output of the attenuator section is switched to a set of filters. Programmable output bits on phase-lock chip U3 (pins 17, 18 and 19) control comparators U14 and U15 which in turn switch diodes CR24-CR30. This selects the appropriate filter or bypasses the filters altogether to improve harmonic rejection of the receiver.

A lowpass filter consisting of C131, 132, 133 and L29, 30 and 31 is used below 60 MHz. A 200 MHz filter consisting of C128, 129, 130, L33 and L6 is used from 60 MHz to 200 MHz. Above 200 MHz the bypass is switched in through CR28 and30. After the filter network, the signal enters a port of the mixer M4.

The A3 RF from J4, goes through a 3 dB pad to improve flatness and then through RF amplifier U16. The output of U16 drives mixer M4 as well as a level comparator circuit formed by U12 and its related circuitry. The detector output serves as a diagnostics flag to signal the A11 processor board in the event that the A1 module does not have sufficient RF input to operate.

When the RF from the A3 module and the antenna signal are mixed together, the result at M4 pin 2 is a 21 to 22 MHz IF frequency. This signal passes through an AGC limiter composed of pin diodes CR2, 3 and inductor L15. When the input to the A1 is greater than 55 dBm, a threshold AGC voltage from the A2 module exerts control over this limiting circuit to prevent later stages from being overdriven. After the limiter, the signal enters a 21 to 22 MHz bandpass amplifier consisting of Q3, 4, 5, 8, and related circuitry. This bandpass filter has 3 dB corners at 20.5 and 22.5 MHz and is designed for maximum flatness in this range. The output of the bandpass amplifier is mixed by M3 with local oscillator frequency LO3 which produces a 3.9 MHz second IF signal at J3. This local oscillator frequency is a product of two phase-locked loops that are controlled by serial data from the A11 module.

One of the loops is an 80 MHz synthesized phase-lock consistsing of U3, 13, Q9, 6 and other associated components. The synthesizer chip internally divides a 3.2 MHz signal from the A6 module down to a 10 KHz reference. Lowpass filter U13 removes the 10 KHz noise from the phase detector output. The correction voltage is then applied to oscillator Q9. Output buffer Q6 feeds one port of mixer M2 and also completes the phase-lock path back to U3. The 80 MHz oscillator is programmable in 10 KHz steps.

A second phase-locked oscillator centered around 61 MHz is composed of U1, 2, Q12, 7 and M1. It generates a 238 KHz reference for the A4 module by dividing by 256 in U7 and is used in the AM mode because it allows 100 Hz resolution steps . Phase-lock U1 drives notch filter U2 which removes the 100 Hz component to prevent it from modulating the VCO. The remaining correction voltage keeps oscillator Q12 on frequency while Q7 buffers the output. The VCO frequency is then mixed with a 60 MHz reference from the A6 module by mixer M1. The output of the mixer goes though a lowpass filter composed of L25 and C119 that removes the 60 MHz component and furnishes the phase-lock (U1) with an AM reference frequency thru buffer amp Q10. The second input to the phase-lock is an internal reference that is derived from the 800 KHz reference from the A6 module.

The outputs of the 61 MHz and 80 MHz loops are mixed at M2 to produce 24.9 - 25.9 MHz (RCVR RVS) or 17.1 - 18.1 MHz (RCVR NOM). A lowpass filter composed of C2-4, L1-3 and related circuitry, filters out unwanted harmonics. Q1 and 2 then amplify the signal to create LO3.

The output of each phase-locked loop is also monitored by window detectors in U11. If one of the VCO's are out of lock, U12 and 10 are tripped as a fault indication for the A11 board.

5.6 A2 RECEIVER IF BOARD

The A2 Receiver IF Board develops the third IF signal for AM, FM and SSB demodulation. It performs squelching functions, AGC control, supplies calibration markers and contains a log amplifier used in the spectrum analyzer mode.

A 3.9 MHz second IF signal from the A1 module is applied to a fixed gain filter amp composed of Q1 and 2. This stage has a 100 KHz bandwidth and is tuned for maximum output via L3 and 4. The signal is then mixed by U1 with a 3.2 MHz local oscillator signal from the A6 board to produce a 700 KHz third IF.

The 700 KHz signal is sent to a third IF amplifier composed of Q6 and 7. The signal is boosted at this stage to provide an optimum signal to noise ratio before other processing of the IF occurs.

Transistor Q8 grounds the emitter of Q6 except when the scan mode is activated. In the scan mode Q8 opens and allows the resistors on the emitter of Q6 to set a higher gain. Thermistor RT1 is for temperature compensation.

Analog switches U2 and 3 act together to direct the IF through a wide or narrow bandpass filter. The narrow bandpass filter is tuned for maximum output by L6, 7 and 8. The output of the wide (lowpass) filter is matched to the narrow filter using wide pot R57. The selected bandpass filter output is then directed into a log amplifier composed of U4, 5, 6, 7 and Q3 and 4.

The outputs of eight successive amplifiers are summed together at a virtual ground created at the emitter of Q3 and buffered by Q4. At low input levels each susccessive amplifier has a greater significance in the amount of signal it contributes to this summing node. As the input signal increases, however, the dynamic range of the most significant amplifier (starting with U7 pin 7) is exceeded and the amplifier saturates. This means it is no longer able to further contribute to the node and the next amplifier closer to the input becomes the most significant and so forth down the line until all amplifiers would be saturated. The logamp has a dynamic range of approximately 70 dB with a 1 dB accuracy. Amplitude pot R74 is used to calibrate the output level.

Diodes CR16 and 17 are used to detect the RF signal and U8 buffers it so the A7 module can use it for the spectrum analyzer display. When the scan mode is not activated, Q5 turns off the supply voltage to the log amp chips to conserve energy and to prevent unnecessary RF radiation.

For the AM, FM and SSB modes, the output of the selected bandwidth filter from U3 is split off and sent to linear third IF amplifier U16. This amplifier is gain controlled by U15 through a 60 dB dynamic range. When the signal strength exceeds this range, further gain reduction is performed by the A1 module via pin 7 of U15. This prevents the A1 from overdriving. The point at which this changeover occurs is set by AGC pot R3. When in SSB, the switch across Q10 is opened to slow down the gain decay time.

In the AM mode, AM detector U17 supplies an audio output that is switched through U14 to the buffer amps in U12. AM pot R166 sets the gain to calibrate the AM output. AM detector U17 also supplies a squelch voltage used by the FM limiter in U19.

Op amp U13 performs the squelch function for AM and SSB by comparing a DC squelch voltage from the units front panel to the AGC voltage from U15 and turning on or off the appropriate switch in U14. When a signal is present, Q9 turns on and activates the signal LED on the unit front panel.

For SSB operation, dual gate MOSFET Q11 acts as a product detector by beating the IF output of U16 against a 700 KHz local oscillator signal from U18. The detected audio is sent to U14 which switches between the detected SSB and AM audio. The audio passes on to U12 and U13A to be filtered and amplified.

The 700 KHz local oscillator consists of U20, 21, 24 and associated components. The VCO that determines the frequency is internal to phase-lock U21. The 700 KHz signal at U21 pin 4 is divided by seven by U20 in order to generate a 100 KHz input for phase-locking purposes at U21 pin 3. The 100 KHz master reference for the phase-lock comes from the A6 and enteres U21 at pin 14. The phase detector output is passed through low pass filter R183, 186 and C122. The control voltage is then buffered by U24 before switch U14 directs it to the VCO control input at U21 pin 9.

For FM operation, detected audio from FM IF system U19 pin 6 is buffered by Q14 and sent to amplifier/filter U10 where R159 sets the amplitude. It is then switched to the FM output via U26.

FM calibrate lines are produced when U9 is turned on through CR10 and 11. The timer output is used as the Z-mod blanking in the A7. The timer output also splits off to a divide by two circuit (flip-flop U11), which causes switch U25 to toggle between the calibration voltages at pins 6 and 7. The output (pin 4) is sent to a buffer U24 and then to U26 whose output alternates between the FM signal and the two calibrate lines at a rate one fourth that of the 555 timer.

5.7 A5 AUDIO BOARD

The A5 Audio Board is a microprocessor controlled programmable audio generator, a precision 1 KHz tone generator, and a programmable multiple frequency tone generator. It also contains the distortion analyzer and the RF output level correction circuitry.

Serial data from the A11 module is clocked through flip flop U3B, nand gate U7C and into microprocessor U4 via flag input $\overline{EFI}$ (U3 pin 24). The serial data describes the type of tone or tones, and all frequency, duration and spacing information.

The microprocessor with the aid of PROM U6 sets up latches U11, 13, 16, 18, 20 and 23 for BCD output rate settings.

Tones generated by the audio generator section are based on pulses from a rate multiplier circuit. Cascaded rate multipliers U12, 15, 17 and 19 are programmed for the rates by the BCD latch outputs. The rate multipliers are strobed by a 2 MHz clock from module pin C. The pulses from the last rate multiplier (U19 pin 6) are inputted to dual divide-by-ten U24 and then sent to range selector switch U27. This allows the rate output to be divided by one, ten or one hundred. The rate from U27 pin 3 drives up/down counters U28 and U29. The purpose of the up/down counters is to sequentially scan addresses in PROM U30. Address lines to U30 are held high by RP2 and the counters pull them low through diodes CR4-11. PROM U30 contains a digitized approximation of a pure sine wave. As the address lines are scanned, an eight bit word is outputted on the PROM's data lines D1 through D8.

An analog to digital converter consisting of resistors R28 through R46 and U31 then converts the eight bit words back into an analog sine wave at a rate determined by the frequency of pulses coming from U27. This analog output is then buffered by U31 and directed to the audio output.

Dual Tone Multiple Frequency (DTMF) generator chip U14 outputs the proper tones as directed by data from the A11 processor board via latch U13. A tone disable (pin 2) on the DTMF allows pin 10 of latch U23 to gate the tones on and off to generate the proper spacing. A 3.579 MHz crystal Y1 serves as a frequency reference for this chip. Its output (pin 16) is filtered and buffered by U21 and associated circuitry to smooth the digitally produced waveform. It is then summed to the audio output by U31.

The 1 KHz reference tone is derived from the 200 KHz reference at module pin D. Dual BCD counter U1 and flip flop U26 divide the 200 KHz reference by 200 to yield 1 KHz. The 1 KHz square wave is then processed by bandpass filter U5A and directed to the 1 KHz output (module pin 17).

Audio for meesuring SINAD enters the distortion input at module pin 20 and goes to leveling amplifier U38A. The signal then goes to amplifier U38B which drives RMS detector U41 and notch filter U42. The RMS detector sets the gain of U38A through op-amp U39A and FET Q2. The RMS detector output from U39A also drives a window comparator (U40) which lights the "signal level" lamp on the front panel through Q1 when SINAD levels are in proper range.

The output of U38B which contains the waveform of interest, passes through a 1 KHz notch filter consisting of U42 and related circuitry. The output at U42 pin 7 is identical to the input except it lacks the 1 KHz sine wave. It is therefore by definition a representation of distortion in the input sine wave.

The level correction circuitry accepts the AM input from module pin F. The amplitude and DC offset are then set by U32A. A series of programmable switches adjust the output level of U32 and 35. The switches are activated by output bits from the data bus outputs of PROM U45 (pins 1-5). The address lines of the PROM are controlled by the microprocessor in the A11 module. Lines F100 to F1000 toggle to indicate what particular range of frequency the unit is programmed for. This in turn programs the level PROM for that particular range.

5.8 A4 GENERATOR BOARD

The A4 Generator Board provides the instrument with RF output in the generator mode. It has circuitry that allows the generator to be AM, FM or phase modulated. The A4 board provides level control as set by the front panel level vernier. It also supplies a 52 ohm non-inductive dummy load for transmitters under test via the RF in/out connector and supplies the power detection circuitry for the front panel power meter.

FM and phase modulation are generated by the same circuit in the A4. When FM generation is required, the audio modulation for the A4 is integrated on the A10 board. The appropriate audio enters through the module via pin 6 and is buffered and/or inverted by switch U27 and op-amp U26. Inverting the signal is a function controlled by a programmable bit on phase-lock U11 via serial data from the A11 processor board. The audio output of U26 (pin 7) is then summed to one input of loop amplifier U4. The loop amplifier is a part of a phase-locked loop that uses the audio to generate phase modulation. The output of the loop amplifier (pin 1) drives 61 MHz VCO U3, CR1 and related components. U5 divides the output of the loop amplifier by 256 to get 238 KHz. This is compared to the 238 KHz reference from the A1 module by phase comparator U1. The phase comparator output is filtered by C18-20 and related circuitry and also drives the loop amplifier. As the audio to the loop amplifier changes in amplitude, the phase-locked loop must shift the frequency of the VCO in order to maintain a virtual ground at pin 2 of the loop amplifier (U4A). This results in linear phase modulation at the VCO output (U3 pin 3).

The VCO drives IF amplifier U6. The IF amplifier is gain controllable over a wide dynamic range via a control voltage at pin 5.

An AM and level audio signal enters the module via pin 2. Amplifier U4B and related circuitry adjust the offset and amplitude of the audio before it is sent to integrator U7A. The integrator then modulates the gain of the IF amplifier for AM generation. The output of the IF amp is buffered by Q1 and goes through two resistive pads before reaching mixer M1. One leg of the first pad splits off to a virtual ground at the emitter of common base amplifier Q2. Q2 drives CR3 to create an AM audio feedback path back to the U7A to minimize AM distortion. The signal from Q2 is also detected by CR4 which allows AGC amp U7B to maintain a constant AM amplitude in the feedback path. If the detected AM does not match the DC level from U4B, integrator U7 adjusts the gain of the IF amp to maintain the virtual ground at U7 pin 2. The A5 module programs DC offsets on the AM/level line to maintain level A4 output across the frequency band.

The second input to mixer M1 is a programmable 70-125 MHz phase-locked loop whose purpose is to serve as an offset generator.

Programmable phase-lock U11 recives serial data from the A11 processor board that reflects the user programmed generate offset. The control voltage from U11 pin 16 goes through a 10 KHz notch filter and drives voltage controlled oscillator CR9, 11, L11, Q5, 6 and related circuitry. The output of the oscillator returns to phase-lock chip pin 9 to serve as one of the references. The other reference is a 3.2 MHz reference from the A6 module. The locked VCØ output goes through a matching pad, buffer Q7, and drives mixer M1.

The output of M1 is 20-21 MHz with no offset programmed. The output of M1 can be attenuated with two front panel selectable 20 dB attenuators. The A11 processor board selects an appropriate lowpass or bandpass filter via a programmable bit from U11 pin 18. If a 12 MHz or less offset is chosen on the front panel, Q9 turns on and the IF goes through a 33 MHz lowpass filter/amplifier consisting of Q12, 13, L14, 15 and related circuitry. If the 45 MHz offset is chosen, Q8 turns on and the IF goes through a 66 to 67 MHz bandpass filter amp. The output of the chosen filter is then summed into mixer M2 via matching transformer T1. The other input to M2 is the A3 board output frequency.

The -7 dBm output of the A3 RF module enters the A4 module through J2. It goes through a 3 dB matching pad and then through an RF amplifier composed of U17, 18, and 19. This RF signal becomes the carrier frequency used by mixer M2.

The output of M2 goes through a selectable 20 dB pad (R176-178) and then goes in one of two directions dependent on what output range the generator is operating in. In the millivolt mode, a high on the mV line (module pin V) turns on Q15 which in turn causes Q17 to turn on. Q17 supplies power to RF amp U23, 24, 25 and biases off CR37. Q15 also turns on Q18 which closes relay K2 and opens relay K1 directing the RF to in/out connector J3. Diodes CR31-34 provide reverse power protection in the event that power is reflected back through J3. The in/out connector J3 has a wattmeter power detection circuit consisting of CR27, 28, C126-127 and related circuitry. The detected RF is buffered by U20B and sent to the 15 and 150 wattmeter drive outputs and drives the cellular watts output through amplifier U21B. The buffer also feeds comparator U20 which is set to trip when more than 100 mw of power is transmitted back into the in/out jack.

When the comparator trips, it turns off Q15 which in turn shuts off the RF amplifier through Q17 and allows CR37 to turn on again. The RF from mixer M2 goes through trim pad R136, 137 and 172. The adjusted output is then attenuated by a 150 watt, 30 dB attenuator. Since Q15 is off, Q18 is also turned off and normally closed relay K1 is closed while K2 is open. This provides the RF output path when the generator is in the microvolt range output mode. The microvolt range is also manually selected from the front panel when the mV line is pulled low thus bypassing the function of the comparator for this purpose.

The 150 watt 30 dB attenuator (AT4), serves as a load for transmitters under test. Temperature sensing diode CR23 is mounted on the heat sink of the attenuator. When the temperature of the heat sink exceeds 100 degrees C, the voltage across diode CR23 lowers causing the output of comparator U21 to go high. This turns on the Load Overtemperature LED on the front panel via module pin 22. It also allows the audio alarm (U22) to turn on as pin 7 of the alarm is no longer pulled low. When no power is applies to J3, the output of comparator U20A goes high and the alarm is shut off via Q19. The RVS power/uV LED is also triggered by the comparator through Q16.

5.9 A7 DEFLECTION BOARD

The A7 deflection board provides the horizontal and vertical deflection voltages for the front panel CRT. It contains the sweep generator used to scan the CRT and sweep the A3 board RF oscillator. It also signals the A3 phase lock circuit to lock and hold before each sweep in the scan mode. The A7 board controls the CRT beam blanking. Other functions include an audio power amplifier and an audio low pass filter for subtone detection.

In the scope mode (scan off), the input from the front panel vertical input goes through switch U7D to vertical amp U6A and 6B. This low level drive is shifted to a high level drive voltage by transistors Q3-6. The output from the low level drive also splits off to an audio low pass filter consisting of U1, 2 and related parts. This five pole filter eliminates the voice range of frequencies on the vertical input and allows the subtones to pass through for detection by the A11 processor board.

The horizontal circuitry is similar to the vertical section. Switch U10 determines if the input comes from an external source or from the A7 time base generator. The selected signal is amplified by low level amp U9B and converted to a high level by transistors Q7-12.

The internal time base is created via a constant current source that charges a capacitor to generate a linear ramp voltage. The constant current source in this circuit is Q14. In the time base (scan off) mode, switches U16 and 20 both connect their pins 4 to 6. This current from Q14 charges a timing capacitor (one of C46, 47, 51, 52) as selected by switches U21 or 22. The resultant ramp voltage at pin 4 of U20 is buffered by U17A which also offsets the ramp voltage in a negative direction due to the reference voltage established by R102 and 118. The output at U17A pin 1 goes from approximately -10 volts to +10 volts. When the ramp voltage starts to go over the reference set at comparator U17B pin 6, the output (U17B pin 7) goes high and triggers a dual one-shot monostable circuit.

A sweep hold off period is set by one shot U15A. The horizontal time pushbuttons of the front panel that select the sweeptime capacitor also select the hold-off time capacitor for U15A in conjunction with logic gates in U18 and switches in U19. When U15 is in the hold off state $\overline{Q}$ goes low which presets sweep gate U14A so that Q of U14A goes high and turns on transistors Q15 and 16. These two transistors dump current from the selected sweep time capacitor to ground and thus return the ramp to its negative most point. This corresponds to the horizontal sweep retracing and holding at the left screen. When U15A times out, $\overline{Q}$ goes high and JK flip flop U14A is free to toggle with the next trigger input at U14A pin 1.

In the event that no trigger signal is present, an auto trigger is incorporated to guarantee a base line in the absence of a input. The same pulse that clocks the sweep hold off time (U11 pin 8) also clocks auto reset U15B. If no trigger input occurs before the time constant set by C60 and R113, then Q output of U15B clears sweep gate U14A and the sweep generator begins the ramp again.

The scan sweep operates in similar fashion but it requires some additonal pulses for marker and reset functions. In scan mode, switches U16 and 20 connect C44 as the sweep time capacitor. This capacitor optimizes the horizontal rate for scan viewing and the horizontal time pushbuttons become inoperative. The $\overline{\text{scan}}$ line also causes Q17 to turn on Q18 which disables the front panel sweep variable (horizontal gain) pot. If the marker button on the front panel is pressed, Q13 turns on enabling marker period one-shot U8A. Since switch U7C is closed due to a high from U13A, the ramp voltage from the generator (TP7) is allowed to trigger marker comparator U9A. The marker comparator goes high when the ramp at pin 3 crosses approximately 0 volts. The exact crossoverpoint is determined by marker calibrate pot R42. When comparator U9A goes high, it trips marker period one-shot U8A which toggles U16 off the scan capacitor for about 20 milliseconds thus temporarily stopping the ramp which causes a bright dot to appear on the display. It also freezes the vertical input voltage via a track and hold circuit by opening switch U7A.

The video output of A2 receiver board goes through amplifier U5B and A. As long as switch U7A is closed, the video voltage appears across tracking capacitor C11, is buffered by U4, goes through switch U7C and is amplified by the vertical electronics. When the marker period one shot opens U7A however, the voltage across C11 at the time of the opening is held and remains until U7A closes again.

After the marker period times out, U7A closes again and switches U16 and 20 reconnect the current source to C44. The ramp voltage then continues to increase from the point at which it stopped until it exceeds the reference set on pin 6 of upper limit comparator U17A. The output of U17B (pin 7) then triggers the sweep hold-off period one shot U15A through U11C. When this occurs the Q output of U15A goes high and triggers reset period one-shot U8B. The low $\overline{Q}$ line of U8B turns on Q19 through U23C. Q19 in turn shuts off switch U26 which causes the spectrum analyzer sweep line (U27 pin 6) to go to 0 volts. U8B also disables the trigger input by setting and clearing sweep gate one-shot U14B.

When the reset period times out, the input trigger is again enabled, U26 closes the sweep ramp path to the A3 module and a new ramp cycle begins.

The A7 board contains a single chip audio power amplifier (U3) which is used to drive the speaker on the instrument. The audio from the volume control is summed with the overtemperature alarm at the input (U3 pin 2) and pin 8 is the low impedance speaker drive.

5.10 A6 LOW VOLTAGE POWER SUPPLY BOARD

The A6 low voltage power supply board regulates the positive and negative 15 volt and +5 volt supply lines and provides over-current protection. Window comparators send a fault signal to the A11 processor board in the event that the positive or negative 15 volt lines are out of calibration. The A6 board provides a 10 MHz TCXO reference and divides or multiplies this reference to generate other reference frequencies. A separate 3.2 MHz oscillator is phaselocked to the TCXO. The A6 board also contains a microphone audio limiter/filter.

The pass transistors Q1-3, transformer and 5 volt rectifier diodes (CR5 and 6) are located external to the A6 board.

AC currents from the power transformer are rectified and charge filter capacitors C5, 6, and 7. C7 is in a fullwave center tap supply. The + and - 15 volt supplies are both fed off the same 32V C.T. winding. Each supply has its own pair of diodes for a fullwave center tapped supply (C5 and C6). The filter capacitors are connected to pass transistors that are in series with their loads. Regulator IC's U6-8 compare the voltage on their respective transistor with an internal reference. The output of each regulator then adjust the on resistance of its respective pass transistor to maintain a constant voltage.

Transistors Q4 and 5 sense the voltage drop across low ohmage resistors in series with the pass transistors in their respective supplies and limit the amount of current each transistor can pass. Q5 sends over-current voltage to the internal current limiter in U7, while Q4 and 10 current limit -15 volt pass transistor Q3, which is located on the chassis. The two positive supplies interact and thus a problem in one supply will affect the other. If the +15 volt supply goes out of regulation it affects the +5 volt regulator V+ and Vc supplies (U8 pins 11 and 12). If the +5 supply changes, the +5 volts to Vout (U7, pin 10) on the +15 volt regulator changes. This relationally changes the output voltage of the +15 volt supply. Thus the 5 and +15 volt supply interact.

The mosFET for the +5 volt supply uses U9 for current limiting. The current sense resistor for U9 is actually a land on the A13 mother board going from A6 pin 1 to pin 25. The derived voltage is sent to U8 pin 2 and actuates the internal current limiting circuit (U8, pin 2).

The plus and minus 15 volt lines are monitored by comparators in U10. If one or both lines are outside the established voltage windows, then the output of U10 (pin 1) drops low as a fault signal to the A11 processor board.

The TCXO supply voltage needs to be noise free to prevent unwanted modulation of the 10 MHz oscillator, thus the unregulated 5 volt supply is used to supply voltage to a three pin 5 volt regulator for the sole purpose of powering the 10 MHz TCXO.

The 10 MHz sinewave output of the TCXO is converted into a squarewave by inverters in U11 and used to drive the divide-by and multiplication circuits that generate the reference standards used throughout the instrument. References generated by the A6 board include 60, 10, 8, 4 and 3.2 MHz. Also generated are 800, 500, 200 and 100 KHz references.

The 10 MHz squarewave from U11E pin 10 drives a tuned multiplier circuit. The first stage (Q7, L3, C33 and related components) is tuned to 30 MHz. The second and third stages (using Q8 and 9) are tuned to 60 MHz.

A 10 MHz squarewave from U11 pin 2 drives binary counter U5. A 1 MHz signal generated at pin 12 goes to counter U2B when it is divided by 5 to generate a 200 KHz reference and divided by 2 to generae a 100 KHz reference.

When the instrument is not in the scan mode, the 1 MHz signal from U5 toggles flip flop U4 to create a switchable 500 KHz sampling drive for the A3 board.

In addition to the 1 MHz output, U5 also divides the 10 MHz TCXO squarewave by 5 to generate a 2 MHz reference at U5 pin 14. This drives multivibrator U3 which acts as a doubler by outputting two pulses at its pin 13 for every pulse arriving at its pins 1 and 9. The 4 MHz output is doubled in the same way by multivibrator U1. The 8 MHz output at U1 pin 13 is sent to output J2 and to pin 11 of flip flop U4B . The 4 MHz output of U4B is switched on by the A3 board whenever the A3 board phase lock chip is operational.

A separate oscillator circuit (CR9, C55, L7, U13C, 13D) generates a 3.2 MHz signal. This is fed to a 4 stage binary counter U14 which divides the signal by 2, 4, and 16. The divide-by 4 sends an 800 KHz reference out board pin 30. The divide by 2 and divide by 16 outputs go to phase detector U13 along with the 200 KHz reference from U2, pin 14. These go to loop filter U15 which sends a DC voltage to varicap CR9 to steer the VCO.

The A6 board contains a microphone limiter and filter. The microphone input is amplitude limited by Q3 and 4 and filtered by 3 KHz bandpass filter consisting of U9 and related components.

5.11 A8 HIGH VOLTAGE POWER SUPPLY BOARD

The A8 high voltage power supply board provides regulated -1200 volt and +200 volt outputs. A fault detector signals the A11 processor board if a supply goes out of calibration. The A8 board contains meter circuitry for detecting peak, true RMS and SINAD. It also routes the cellular watts voltage and the selected meter circuit output to the rear panel cellular meter output. The A8 board has provisions for an optional PSOF filter.

In order to generate the -1200 volt supply, high voltage AC from the main transformer (external to the A8 board) is rectified by CR 9-12. The D.C. current charges C9. The resulting high voltage is divided across R12-21. Voltages fo the front panel CRT are taken from these points. Capacitors C7 and 8 are located across the resistor network to prevent blanking pulses from feeding back into the network. Comparator U3 holds its output (pin 6) at the reference set at pin 3 using H.V. adjustment R4. If the high voltage supply starts to lose regulation it is proportionally reflected at pin 3 of the comparator causing Q4 to compensate the output voltage. Resistors R22-26 are bleed resistors that drain C9 when the instrument is shut off.

To generate the +200 volt supply; high voltage A.C. from the main transformer (external to the A8 board) is rectified by CR1-4. The resulting D.C. current charges C5. Pass transistor Q1 is in series with the output load. Q2 senses voltae as a function of current through R27 and limits current by lowering the bias on the base of Q1. Op-amp U1 compares the output voltage (TP1) to a reference set on pin 3 by R33 and 34. It regulates the output voltage via Q3 which biases Q1.

A voltage divider consisting of R3, 6 and 5 allows correction of astigmatism on the front panel CRT.

The output voltages of the -1200 volt and the +200 volt supplies are compared to reference voltages by fault detector U2. If either supply goes out of calibration, the output of the fault detector goes low to alert the A11 processor board of an error condition.

The A8 board drives the front panel meter and contains all the detection circuitry with the exception of the power detectors which are found on the A4 board. The modulation signal on module pin V of the board is detected by U11, CR17, 18 and related parts. It is also directed through amp U5 to RMS detector U7 which sends out a corresponding linear voltage on pin 10 and a log scaled voltage on pin 8. If a PSOF filter option is installed, a jumper is connected from module pin R to ground. This causes U10 to switch the output of the filter into the input path of the RMS detector. After going through buffers in U5 the two signals are presented at the inputs on switch U8. Switch U8 selects the input to meter drive U5C. The output of U5C drives the front panel meter and also switches through U10 to the rear panel meter out line (module pin 16) except in the watts mode. In the watts mode, U10 pins 11 and 10 open and pins 7 and 6 close. This directs the cellular watts input (module pin 17) to the rear panel cellular meter output (module pin 16).

5.12 A9 L C D BOARD

The A9 LCD board is an intelligent alphanumeric controller/driver system that includes an LCD for visual monitoring of a majority of the instrument's settings and measurements.

The 300 segment, 4 back plane multiplexed display is controlled by the A11 processor board via three alphanumeric LCD controller/driver chips. Each chip handles a maximum of 128 segments, thus one chip is in control as a master and the remaining two chips are slaved to it.

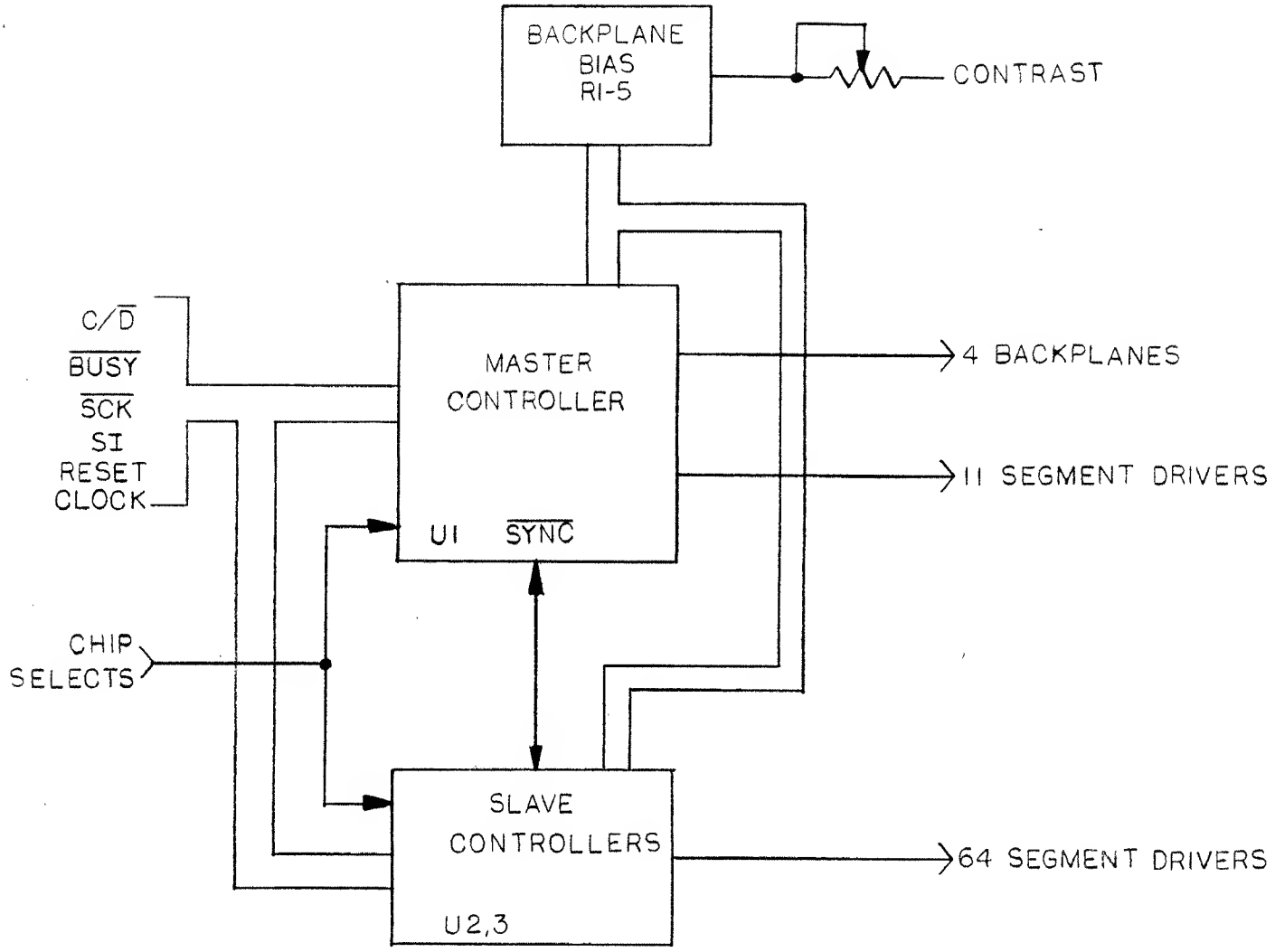
The A11 processor board serially enters 8 bit words on the SI line while clocking the $\overline{SCK}$ line. A C/$\overline{D}$ line tells the A9 board if the incoming information is a command or data. Each controller/driver chip is inhibited until selected via lines CS1 -CS3.

The A9 board drops the $\overline{BUSY}$ line low to indicate it is busy and cannot accept new data.

The LCD display is connected to the printed circuit board through an elastomeric connector on each side of the LCD plane. It should only be removed if absolutely necessary because it is difficult to align properly and small bits of dust or other contaminates can insulate the connections resulting in LCD malfunctions.

The display contrast can be adjusted according to personal preference via R4. The optimum viewing angle is about 30 degrees below the level of the display.

A9 DISPLAY BOARD BLOCK DIAGRAM



5.13 A12 INVERTER BOARD

The primary function of the A12 board is to convert approximately 12 volts D.C .to the needed A.C. voltages necessary for the A6 and A8 power supplies. External to this card is the 12 volt switching power supply, power transformer, and a power source switch that allows the unit to be used on the internal power supply and optional sealed lead-acid D.C. battery pack, or external 12 volt power source. This board is not needed on A.C. units as a different power transformer is used that has tapped 110/220 primary windings. The battery has almost identical characteristics to the lead-acid battery that is commonly used in automobiles.

In early units U1, a 555 timer, is used as an oscillator to drive a dual JK flip-flop (U2). An inverter drives one section of U2 and the outputs are nor'ed together by U3C, D. Either output U4A or U4C is high, with a slight amount of dead time when both outputs are low. These two outputs ultimately drive the two halves of the power transformer.

On latter units, a small P.C. board containing a TL594 pulse-width modulator control IC (U1) is mounted above the main board. Internal to the chip is the oscillator, voltage regulator, dead-time contact and push-pull output circuit that provides two outputs that are 180 degrees out of phase. The five volt unregulated supply at E1 controls the level sensing of U1 via R8., 11-13. When a freshly charged battery is being used, the voltage is high, and U1 outputs narrow pulses. As the battery voltage drops, U1 widens the pulse-width to maintain the same voltage level at E1. Controlling the duty cycle in this way conserves battery potential resulting in extended battery life. It also optimizes pass transistor currents allowing them to operate cooler. U6A-D selects which pair of transistors will be driven. Voltage comparator U8 is high at pin 6 when the battery voltage is above 11.5 volts. This enables U6A and C which drives buffers Q4 and 10 and output transistors Q3 and 9. When battery voltage drops below 11.5 volts, the output of U8 goes low which enables U6B and D which drive output transistors Q5 and 7 through buffers Q6 and 8. This second pair of drivers and output transistors are operating on different taps of the transformer primary. When battery voltage drops down to about 11.1 volts, voltage comparator U5A activates, and turns on the low battery LED via U9 and Q1. When battery voltage drops further to approximately 10.5 volts, comparator U5B activates, and turns the unit off via RS flip-flop U7C, D and Q2.

5.14 A13 MOTHER BOARD

The A13 Mother Board provides the majority of interconnections between boards via edge card connectors, ribbon cables and hard wire. For heat sinking purposes, it contains CR5, 6 and Q1-3. These parts are all used by the A6 low voltage power supply. The A13 Mother Board also contains level adjustment pot R5, twelve volt regulator U1 and a few other miscellaneous resistors.

5.15 AC/DC OPTION

The 3100 Service Monitor is available with AC/DC operation (*optional). The AC to DC switching power supply serves to supply DC voltage for battery pack (*optional) charging and unit operation.

The switching power supply is internally mounted to the Rear Panel asembly. A protective shield is mounted directly above the cricuit board to guard against electrical shock. High voltages are present on the exposed circuits. The AC line voltage input is located at the slots in the bottom of the chassis. **WARNING The power On/Off switch does not disconnect AC line voltage from the power supply terminals.** The line cord should be unplugged before servicing the unit.

The DC power supply is a standard switching power supply manufactured by Compower. AC power is converted into high voltage DC (approx. 200V DC). The DC power is switched by Q103 at 130 kHz to 145 kHz through a step-down transformer. The low voltage AC output is rectified by CR112 and CR114 and filtered to produce DC power. Each board is modified to allow room-temperature control of the DC output voltage. This is necessary to provide protection for the 12V battry pack in high ambient temperatures. As the room temperature increases, the voltage across CR118 decreases, which causes the DC power supply voltage to decrease.

To improve voltage regulation, Q107 has been added as a shunt regulator which continues to hold the power supply voltage during periods of little or no load. The DC output is supplied directly to the 12V battery pack and through the 10 amp fuse to S1 (INT/EXT) switch, then to E1 and E2 of the A12 Inveter board.

The DC power system of the 3100 is not connected to chassis ground. This allows operation from either positive or negative ground power systems without worry of short-circuits. Do not attempt to change this wiring system.

SECTION 6

MAINTENANCE

6.1 INTRODUCTION TO PERFORMANCE TEST

The information in Section 6.2 provides a systematic test procedure for the Model 3100 Service Monitor. This performance test can be used whenever the 3100 specifications require verification. This test can be helpful as an "incoming inspection" test. It is recommended that the user or servicing technician read Sections 2 and 3, Installation and Operation, in this manual. In Table 6.1 there is a list of reommended test equipment. Test equipment with equivalent accuracy and resolution may be substituted. It is critical that the test instruments be calibrated to laboratory standards. Table 6.2 of this section is a check list that follows each step of the performance test. The check list should be saved for future reference.

6.1.1 TURN ON

Set up the 3100 with the necessary power supplies and test equipment. Press the "Power" button "in".

During the power up there will be a short delay while the microprocessor initializes the unit parameters. Any diagnostic messages seen on the display at this time should be noted and refer to Section 6.3 on Diagnostic Messages.

Table 6.1 RECOMMENDED TEST EQUIPMENT

Equipment	Critical Requirement	Recommended
Signal Generator	.1 to 1000 MHz Maximum output >10dBm	HP8642A
DDVM	4 1/2 Digit Display dB (relative)	Fluke 8050A
Audio analyzer	20 Hz to 100kHz Maximum Output ≥ 6Vrms	HP8903A
Frequency Counter	60MHz with 1Hz resolution Time Base ±.5ppm Traceable to WWV	HP5383A
Spectrum Analyzer	1 to 1000MHz Display: 1dB, 2dB, 10dB	HP8568
Pre-Amplifier	.1 to 1300MHz 20dB Gain; 50 Ohms	HP8447D
Modulation Analyzer	Tuneable 1 to 1000MHz Selectable Bandpass .3 to 3kHz	HP8901
Transmitter	VHF or UHF 10W and 100W	Uniden Force APU44 Uniden Force ARU241
RF Watt Meter	VHF and UHF	Bird/Thru-Line
450MHz Filter	Bandpass <10MHz	Wavetek
BNC to BNC cable	.1 to 1000MHz	Comtest Systems
Clip to BNC cable	DC to 500kHz	Comtest Systems
Extender Card	44 pin	Comtest Systems
Extender Card	72 pin	Comtest Systems
DC Power Supply	Adjustable 10 to 15VDC Continuous Current>6 amps	HP6263B Power Supply

6.2. Performance Test

The performance test basically follows this procedure:
Audio Ouputs, Audio Inputs, RF Outputs, RF Inputs,
Special Functions

6.2.1. MOD OUT

Set-up the 3100 with power "on", (AUDIO GEN) **1** (kHz),

turn AUDIO/CODE LEVEL full clockwise, CONT button "in", 1kHz button "out". Connect a cable from MOD OUT to a DVM or (Audio Analyzer*). Measured value approx. 1.5Vrms. * Distortion measurement < 1%. Press 1kHz button "in", CONT button "out", turn 1kHz full clockwise. Measured value approx. 1.5Vrms. * Distortion measurement < 1%.

6.2.2. DEMOD OUT

Set-up the 3100 to (RCV), MOD [ ], 6 [ ], Squelch "open".

Connect a cable from DEMOD OUT to a DVM. Audio or white noise should produce a measurement > 0Vrms.

6.2.3. EXT VERT | VOLT

Set-up the 3100 to (GEN), VOLT [ ], 6 [ ], Squelch "closed".

Connect a cable from an audio source (Audio Analyzer) set to 5Vrms, at 1kHz, to the EXT VERT jack. The 3100 meter should read 5V. Readjust the audio source to 4.243Vrms. Make sure that the VERT VAR knob is in the "cal" position. The 3100 oscilloscope should show +/- 6V peaks.

6.2.4. EXT VERT | SINAD

Set-up the 3100 to 1.8 [ ], connect a cable from MOD OUT to EXT VERT.

Press the 1kHz button "in". Adjust the level to 1Vrms on the meter.

Press the SINAD [ ] button, the meter should read < 28dB and SINAD LED sould be "on".

6.2.4. cont.

Press the 1kHz button "out". Press the VOLT button.

Set-up the 3100 AUDIO GEN **3** kHz, press the CONT button "in".

Adjust the AUDIO/CODE LEVEL to .25Vrms on the meter. Press the SINAD button, the meter should read approx. 0dB. Press the 1kHz button "in", the meter should read approx. 12dB.

6.2.5. **EXT MOD**

Set-up the 3100 for GEN, MOD, 6, FM, press CONT "out", and 1kHz "out".

Adjust the EXT MOD pot to mid-range, connect a cable from the EXT MOD jack the audio source set to .6Vrms, at 1kHz. The meter should read approx. 5kHz deviation.

6.2.6. **EXT HORZ**

Connect a cable from the EXT HORZ jack to the audio sorce set to 1Vrms.

Push the EXT button, the oscilloscope should show a horizontal line.

6.2.7. **GEN** **FM**

Set-up the 3100 for AUDIO GEN **1** kHz ,and push the 1.0 (mS/div) button in the HORZ section. Disconnect all cables from the front panel. Push the CONT button "in", and adjust the FM modulation for 5kHz on the meter and scope.

Set-up the 3100 to RF FREQ **450.3** MHz

Push the 100 mV buttons, and adjust the OUTPUT LEVEL knob to 200mV.

Connect a cable from the RF IN/OUT jack to (Modulation Analyzer*) set for FM avg. at 450.3MHz. Set the bandwidth at 300Hz to 3kHz. The modulation analyzer should read approx. 3.54kHz avg.=5kHz peak.

*If a tuneable modulation analyzer is not used it will be necessary to connect a bandpass filter in line to the modulation analyzer.

6.2.8. [GEN] [ØM]

Push the [ØM] button, and set the (Modulation Analyzer*) to ØM.

The measurement should be approx. 3.54rad avg.= 5rad peak.
* At 1kHz audio 5kHz FM = 5rad ØM.

6.2.9. [GEN] [AM]

Push the [AM], [10 (mV)] buttons, set the (Modulation Analyzer) to AM.

The measurement should be approx. 35.4% avg.= 50% peak.

6.2.10. [FREQ ERR]

Set-up the 3100 to (RCV), (FREQ ERR), [FM], [MOD], [NAR] and connect a cable from the ANT jack to a (Signal Generator*) set to 450.3MHz with no modulation. The LCD will display frequency error in the lower right corner. *The frequency error should be less than +/-60Hz if the signal generator is locked to a WWV reference. If the generator has more than 1kHz err, adjust it near zero for the the following tests. *If the generator is locked and the err is >1kHz, see the TIME BASE section of the Calibration Procedure.

6.2.11. [RCV] [FM]

Set-up the 3100 to (RCV), [FM], [NAR] and connect a cable from the ANT jack to a (Signal Generator*) set to 450.3MHz with 5kHz FM at 1kHz. The 3100 meter and scope should read approx. 5kHz peak. To check the FM CAL markers, push the [+/-5] button and two horizontal lines should be touching the top and bottom peaks of the audio signal on the scope. Push FM CAL "off". *Verify the FM level with the modulation analyzer.

6.2.12. [RCV] [ØM]

Push the [ØM] button, and set the (Signal Generator*) to 5rad. The meter and scope should read approx. 5rad peak. *At 1kHz audio 5kHz FM = 5rad ØM.

6.2.13. [RCV] [AM]

Push the [AM] button, and set the (Signal Generator) to 50% AM, set the generator output level to -50dBm. The 3100 meter and scope should read approx. 50% AM.

6.2.14. [RCV] [SSB]

Push the [SSB], [18] buttons, set the (Signal Generator) to CW, and offset the generator frequency by 1kHz. The 3100 meter should read approx. 80 to 100%, ≈1kHz tone should be detected. Reset(Sig. Gen.) to 450.3MHz.

6.2.15. [SCAN]

Push the [ON], [-30] (REF LVL dBm), and [MARKER] buttons in the [SCAN MODE] section and adjust the FREQ SCAN knob to "nar". Adjust the analyzer display to center with the <POS> knob. The peak of the -50dB signal should be approx. -20dB below the REF LVL line. Step the (Signal Generator) level in 10dB steps down to -100dB the peak should drop approx.10dB/div. Push the [-10]dB button, set the signal to -30dB. The peak should be on the -20dB line. Push the [+10]dB button, set the signal to -10dB. The peak should be on the -20dB line. Turn the FREQ SCAN knob to the "wide" position, the dot MARKER should remain on the center of the peak. Step the signal generator +/-1MHz, the peak should move about +/-1div Turn the FREQ SCAN knob to "nar", and step the signal generator +/-50kHz the peak should move about +/-1div. Press the ON button "out".

6.2.16. [WATTS]

Set-up the 3100 for [WATTS], [15] and connect a cable from the RF IN/OUT jack to a 10W VHF rf source. Verify the RF level with a (Watt Meter). The 3100 meter should read within 7%+/-3% of full scale.

Push the [150] button and connect a 100W UHF rf source. Verify the RF level with the (Watt Meter). The 3100 meter should read within 7%+/-3% of full scale.

6.2.17. OUTPUT LEVEL

Set-up the 3100 for [RF FREQ] 152.34 [MHz] [DUPLX RCV] [GEN OFFST] 0 [kHz], CW [ ], X10 [ ], mV [ ] set the OUTPUT LEVEL dial to 3.0. Connect a cable from the RF IN/OUT jack to a (Spectrum Analyzer); adjust the analyzer to 152.34MHz, and set up the display to show a 20dB drop. Turn the OUTPUT LEVEL dial to 0.3, and check that the signal peak drops approx. 20dB.

Set-up the 3100 to X100 [ ], mV [ ] set the OUTPUT LEVEL dial to 0dB, and push the ON [ ] button "in",and connect a cable from the RF IN/OUT jack to the ANT jack. The 3100 should display a horizontal line approx. -10dB from the REF LVL. Step the OUTPUT LEVEL down 20dB [X10] [x1]... ; the horizontal line should drop 20dB for each step,*X0.1mV = X100µV. Use the [-10] &[-30] REF LVL steps to follow the RF level down. The last output step will be below the analyzer range.

6.2.18. 2 TONE

Set-up the 3100 to X100 [ ], mV [ ] set the OUTPUT LEVEL dial to 0dB, and push the ON [ ] button "out", connect a cable from the RF IN/OUT jack to the ANTjack.

Enter [SQLCH CODE] [2 TNE 2] and push FM [ ], MOD [ ], 6 [ ] press the CONT button "in", and adjust the AUDIO/CODE LVL for about 2kHz deviation. The 2 TONE will continue until the CONT button is "out". The BURST button will send one (call) when pressed.

6.2.19. 5 TONE

Enter [SQLCH CODE] [5 TNE 5] and press CONT or BURST. The 3100 will send the last 5,6, or 7 TONE group that was ENCODEed.

6.2.20. DTMF

Enter [SQLCH CODE] [DTMF 4] and press CONT or BURST. The 3100 will send the last DTMF group ENCODEed.

6.2.21. SUBTONE

Set-up the 3100 for AUDIO GEN **123** Hz , select SUB-TONE , and push the CONT button "in". The LCD should display the audio frequency 123Hz in the lower right hand corner.

6.2.22. MOD FREQ

Set-up the 3100 for AUDIO GEN **1.23** kHz , select MOD FREQ , and push the CONT button "in". The LCD should display the audio frequency 1.23kHz in the lower right hand corner.

6.2.23. DIG

Enter SQLCH CODE DIG 3 , check the DIG code displayed on the LCD and note it. Now set-up the 3100 to SHIFT SUB-TONE the LCD should display the decoded DIG code followed by a -DIG code, which is the decode value for an audio signal that is 180° out of phase.* DIG modulation must be less than 2kHz FM deviation.

6.2.24. LISSAJOUS

Enter AUDIO GEN , and pull the <POS> knob "out". The 3100 scope should display a one cycle lissajous pattern.

6.2.25.

If your 3100 Service Monitor fails to perform any of these test, please refer to Section (6.4.) on Service and Calibration in this manual.

Table 6-2

Performance Test Record

Section	Test	Min. Spec.	measured	measured	measured	Max. Spec.
6.2.1.	Audio Synth. Max.	>1.4Vrms				1.6Vrms
	Fixed 1kHz Max.	>1.4Vrms				1.6Vrms
6.2.2.	Demod Out	>0V				√
6.2.3.	Volt, Meter RMS	4.7Vrms				5.3Vrms
	Volt, Scope PEAK	5.7Vpeak				6.3Vpeak
6.2.4.	Sinad, -30dB	≤-28dB				-30dB
	Sinad, LED	√				
	Sinad, 0dB	-1dB				0dB
	Sinad, -12dB	-11.5dB				-12.5dB
6.2.5.	Ext Mod	.3Vrms				.9Vrms
6.2.6.	Ext Horz'	+/- 3div				+/-5div
6.2.7.	Gen, FM	3.4kHz avg				3.7kHz avg
6.2.8.	Gen, ØM	3.3Rad avg				3.7Rad avg
6.2.9.	Gen, AM	34% avg				37% avg
6.2.10.	Freq Err	0 Hz				<+/-60Hz
6.2.11.	Rcv, FM	4.75kHz				5.25kHz
	FM CAL markers	4.75kHz				5.25kHz
6.2.12.	Rcv, ØM	4.75Rad				5.25kHz
6.2.13.	Rcv, AM	47%				53%
6.2.14.	Rcv, SSB	70%				100%
6.2.15.	-50dBm(-30dB ref lvl)	-18dB				-22dB
	10dB/div	0dB				+/-2dB
	-10dB ref lvl	-18dB				-22dB
	+10dB ref lvl	-18dB				-22dB
6.2.16.	Watts, 15	reading+/-7%				+/-3% fs
	Watts, 150	reading+/-7%				+/-3% fs
6.2.17.	Output Level dial	-18dB				-22dB
	Output Level steps	0dB				+/-2dB
6.2.18.	2 Tone (Cont)	√				
	2 Tone (Burst)	√				
6.2.19.	5 Tone	√				
6.2.20.	DTMF	√				
6.2.21	Subtone	√				
6.2.22.	Mod Freq	√				
6.2.23.	Dig	√				
6.2.24.	Lissajous	√				
			DATE	DATE	DATE	

6.3 DIAGNOSTIC MESSAGES

The 3100 Service Monitor features an internal self-test system which allows the microprocessor to monitor major unit functions. During normal operation the processor routinely checks error lines. Any error encountered causes the processor to immediately display a diagnostic message on the LCD.

Some messages only appear briefly during power-up. This condition is usually not a problem, but could indicate a line voltage or power supply limitation is being reached. If the unit continually displays a diagnostic message after power-up, it may be necessary to turn the unit off and on to clear a latched condition. If the diagnostic message will not clear, contact the Comtest System Customer Service Department for help (see Section 2).

Whenever an error condition causes a diagnostic message, the keyboard functions are automatically locked out. Most error conditions are serious enough to cause the overall operation of the unit to be unreliable. It will be helpful to turn the unit off and note if more than one message is being displayed when turned on. Each effected message will be displayed and replaced by a message with higher priority. The messages are ranked in the following order:

A1 Low Drive
A1 Unlock
A3 Low Output
A3 Unlock
A4 Over Mod (A4 unlock)
A6 ±15 V (uncal)
A8 Uncal (hi-volts)

Only the messsage with highest priority will be displayed continuously.

It is possible that no display will be present on the LCD. This can be caused by several conditions.

1. 5V Power Supply Overload (unit) (A11).
2. Secondary processor failure (A5) (A9).
3. Primary processor failure (A11).
4. Loss of 8 MHz clock signal from (A6).
5. AC or DC Supply voltage too low.

The diagnostic system may be temporarily disabled by pushing DIP switch S1 to the "closed" position and turning the unit "off and on" to recycle the microprocessor. This will not fix the error, but will allow further troubleshooting.

6.4 SERVICE & CALIBRATION

The 3100 Service Monitor is a highly accurate measurement instrument. Should it become necessary to adjust or repair your 3100, contact the Comtest Systems' Customer Service Department for assistance (refer to Section 2). The following sections will guide you through disassembly, repair, and reassembly of your unit. The 3100 Service Monitor features modular, P.C. board construction for convenient servicing.

6.5 DISASSEMBLY

WARNING!

THIS INSTRUMENT USES HIGH VOLTAGES WHICH CAN BE LETHAL.
ONLY EXPERIENCED SERVICE PERSONNEL SHOULD BE ALLOWED
TO DISASSEMBLY OR CALIBRATE THIS INSTRUMENT.
-1200 VDC! ON A8 CIRCUITS
200 VDC! ON A7 CIRCUITS

Before disassembly, disconnect AC power (DC units - make sure the power switch is "off"!) from the unit. Disassembly will be easier when the unit is standing on its rear panel. To remove the instrument top cover, remove the six [#6] screws (three on each side) and four [#4] screws (two on top front - two on top rear), and lift the cover.

To remove the instrument bottom cover, remove the five [#6] screws (two on left side - three on right side) and four [#4] screws (two on bottom front - two on bottom rear), and lift the cover.

If it is necessary to remove the High Voltage cover, remove the seven [#4] screws, and carefully remove the cover.

To remove the Front Panel assembly, the top and bottom covers must be removed. Now disconnect the three ribbon cables on the bottom side of the unit, and disconnect the Power Switch harness connector. Disconnect the three coaxial cables from the top of the unit J3 on the A4, J5 on the A1, and J4 on the A10. Remove the four [#4] screws (two on each side) securing the front panel brackets to the chassis. Carefully lift the front panel assembly straight up from the instrument.

Disassemble the unit only as necessary to adjust or repair each section. Refer to the unit diagrams for cable and hardware orientation when reassembling. The unit is reassembled by reversing the above procedure.

6.5.1 CIRCUIT BOARD REMOVAL & SERVICING

The Comtest Customer Service Department can help you troubleshoot most problems down to one P.C. Board or circuit. A replacement board can be shipped immediately.

To remove the R.F. boards (A1 through A4), remove the instrument top cover. Set the unit in its normal operating position. Disconnect the related coaxial cables. Remove the two [#4] philips screws which hold the assembly (one at each end), and pull the board assembly straight up using the knurled knobs. When removing a board, check the condition of the gold edge connector. Remove any oxidation by carefully rubbing the gold

pins with a standard pencil eraser. Reinstall these boards by reversing the above procedure. **(NOTE: HARNESS CABLES ARE NOT KEYED. NOTE ORIENTATION BEFORE REMOVING AND REFER TO UNIT DIAGRAM BEFORE APPLYING POWER.)** The boards under the High Voltage cover can be removed by disconnecting any related cables and pulling straight up on the plastic tabs on each end of the board. When removing a board, check the gold edge connector for oxidation. Reinstall the board by pushing it down into its slot and reconecting its cables.

If the 3100 has experienced a major failure, it will be easier and faster to return the defective assembly for repair. If the unit fails to meet one or more of the published specifications, after a long period of use in the field, recalibration can be performed by the user.

6.6 CALIBRATION

The following sections detail the procedure used to calibrate the 3100 Service Monitor. A list of recommended test equipment is given in Table 6-1. While it is not necessary that this exact equipment be used, it is critical that the equipment be calibrated to an accuracy equal to or better than 3100 specifications.

DUE TO THE HIGH VOLTAGES USED INSIDE THIS INSTRUMENT, ONLY EXPERIENCED SERVICE PERSONNEL SHOULD BE ALLOWED TO MAKE MEASUREMENTS AND/OR ADJUSTMENTS ON THE INTERNAL CIRCUITRY.

It is recommended that anyone servicing this instrument first read and understand Sections 2, 3, & 5 of this manual. This manual contains schematics and component layouts for each P.C. board. The test points and adjustment controls are marked on each circuit board by etching. On later versions the locations are silk-screened onto the board.

The following calibration procedure will allow you to work through each section step-by-step. Since most of the circuit systems are interrelated, it is necessary to start at the beginning of the procedure and follow each step to the section requiring calibration.

6.7 CALIBRATION PROCEDURE

Set up the 3100 in its normal operating position with the necessary power supplies and test equipment for the calibration procedure.

6.7.1 METER ZERO ADJUST

With the unit power off, adjust the meter to the zero position by carefully turning the screwdriver adjustment below the meter.

6.7.2 LOW VOLTAGE POWER SUPPLIES

Remove the high voltage shield. Set the DVM to measure a 20 VDC range. Connect the negative lead to chassis ground, and with the positive probe measure the voltages at the following points on the A6 circuit board.

		Adjustment Control
Test Point 1	5 VDC +/- .01V	R14
Test Point 2	15 VDC +/- .02V	R10
Test Point 3	-15 VDC +/- .02V	R 6

Any voltages not within normal limits may be adjusted by the listed control. Record the measurements.

6.7.3 HIGH VOLTAGE POWER SUPPLIES

Set the DVM to measure in a 200 VDC range. With the positive probe, CAREFULLY measure the following points on the A8 circuit board.

	Adjustment Control
Test Point 1 200 VDC +/- 4V	(not adjustable)
Test Point 2 -135 VDC +/- 1V	R4

6.7.4 LINE VOLTAGE REGULATION

Connect the 3100 AC line cord to the variac power source. Set the line voltage to 108 VAC. Set the DVM the 200mV AC range. With the positive probe, measure the ripple voltage on Test Point 1 of the A6, it should remain less than 5mV RMS. Check the ripple on Test Point 2 of the A8, it should remain less than 400mV rms.

Return the AC power supply to 117 VAC.

6.7.5 FRONT PANEL INDICATORS

Press the following push switches, and check for proper operation of the front panel LED's:

Selected Switches	Active LED
WATTS	W
VOLTS	V
SINAD	dB
MOD and ØM	RAD
MOD and FM	kHz
MOD and CW	None
MOD and SSB	None
MOD and AM	% x 10
ON [SCAN]	ON
OFF [OUTPUT LEVEL]	OFF

On the keyboard enter the following setting:

RF FREQ, 152.35, MHz, RCV, AUDIO GEN, 1, kHz, ΔF, 0, Hz

Press the following buttons:

Volt, 6, 1 kHz "in", CONT "out", FM

Turn the Squelch control to the closed position "full clockwise", the Squelch LED should be "off".

6.6.1 CALIBRATION PROCEDURE INDEX

6.7.6 FIXED 1 kHz TONE

Turn the 1 kHz knob to the "full clockwise" position. Connect a cable from the Mod Out jack to the (Audio Analyzer). Set the analyzer to Volts mode. The audio level should measure greater than 1.4 Vrms. Adjust R4 [1 kHz] for 1.5 Vrms. Set the analyzer to Distortion mode. The audio distortion should measure less than 1%.

6.7.7 AUDIO SYNTHESIZER

Press the 1 kHz button "out", and push the CONT button "in". Turn the Audio/Code level knob "full clockwise". Reset the analyzer to Volts mode. The measured audio level should be greater than 1.4 Vrms. If not, adjust R26 [CH-A LEVEL] for 1.5 Vrms. Set the analyzer to the Distortion mode. The audio distortion should be less than 1%. Reset to Volts. R46 [DAC-ADJ] controls distortion level, adjust for minimum.

6.7.8 METER, RMS

Set the (audio analyzer) to output 1 kHz at 5 Vrms. Connect the analyzer to the 3100 Ext Vert jack, and check that the Volt and "6" buttons are pushed in. Check the 3100 meter for a reading of 5V ±.1V, if it does not fall within this range, connect a (clip lead - BNC) cable from chassis ground and Test Point 3 on the A8 to the analyzer input jack. The voltage at this test point should be 150m Vrms ± 3mV (143 mV on earlier units). Set the analyzer to DC Volts and connect the clip lead to Test Point 6. The voltage at this point should be 2.5 V DC ±.02 V; R53 [rms] adjusts this voltage. Adjust R56 [MTR ADJ] for a meter reading of 5V ±0.1V. Disconnect the (clip lead - BNC) cable.

6.7.9 SCOPE, AC/DC COUPLING

Connect the cable from Ext/Vert jack to a function generator set to 4 VP-P at 1 kHz. Adjust the function generator DC offset ±, and note that the sine wave display moves up and down in relation to this action. Pull "outward" on the Vert position knob, and vary the DC offset again ±. Note that the sine wave should now tend to remain centered on the scope. Push the Vert position knob "in", and reset the function generator to zero DC offset.

6.7.10 SCOPE, FRONT PANEL CONTROLS

Vert Position (clockwise) = upwards
Vert Variation (cal to C. C. W.) = decreases 3 to 1
Horz variation (cal to C.C.W.) = slower 9 to 1
Horz position (clockwise) = right

The scope display should perform as shown. If not, this indicates an internal wiring problem.

6.7.11 SCOPE, GAIN

Center the scope display and return the knobs to their calibrated positions. Reconnect the cable from the Ext/Vert jack to the (audio analyzer) and set the analyzer to output 4.243 Vrms at 1 kHz. The scope should display a sine wave with ± 6V peaks ±0.2V. If it is necessary to adjust the gain, first make sure that te display is focused by adjusting the brightness and focus controls located on the rear panel. Also adjust R3 [ASTIG] on the A8, then adjust R34 [VERT GAIN] on the A7.

6.7.12 METER & SCOPE BANDWIDTH

Program the audio analyzer frequency from 20 Hz to 100 kHz and check that the sCope display remains within ± 1V of 6V peak and the meter remains within ± 0.7V of 4.24 VRMS. No adjustment.

6.7.13 METER & SCOPE RANGE SWITCHES

Reset the audio analyzer to 6Vrms at 1 kHz. Push the "18" button on the 3100. Read the meter and check that it shows 6V ± 0.1V. Set the audio level to 2 Vrms, and push the "6" button. The meter should read 2V ± 0.1 V. Set the audio level to .6 Vrms and push the "1.8" button. The meter should read .6V ± 0.1V. No adjustment.

6.7.14 HORIZONTAL SWEEP

Set the audio analyzer to output 1 Vrms at 100 Hz. Push the 10mS/div button in the scope section. Count the total number of cycles displayed. The scope should show ≈ 10 cycles (1 cycle/div). Check the following frequencies and ranges:

1 kHz	1 mS/div
10 kHz	0.1 mS/div
100 kHz	.01 mS/div

All ranges should be within ± 1 cycle of 10 cycles total. The sweep rate is adjusted by R98 [sweep] on the A7 board.

6.7.15 EXT HORIZONTAL

Reset the audio analyzer frequency to 1 kHz and connect the cable from the analyzer to the Ext Horz jack. Press the "EXT" button and check that the scope display shows a horizontal line ≈±3 divisions. This display is controlled by a factory select value for R122 on the A7 board, with a range of 10 to 10K ohms.

6.7.16 AUDIO FREQUENCY COUNTERS

Disconnect the cable from the audio analyzer, and reconnect it from Ext/Vert to Mod Out on the 3100. Check that the LCD shows Audio Gen 1 kHz. If not, enter Audio Gen 1 kHz on the keyboard. The fixed 1 kHz should be off. Push the Cont button "in" and adjust the Audio Code knob for a reading 0.4 Vrms. Check that the SINAD LED is lit. Enter Mod Freq on the keyboard, and check that the LCD displays Mod Freq 1.00 kHz. Now enter Audio Gen, 123, Hz, on the keyboard, then enter Subtone. Check that the LCD displays Subtone 123 Hz. Mis-counts more than ± 1 Hz indicate internal problems.

6.7.17 SINAD

A) Enter Audio Gen, 3, kHz on the keyboard, and set audio level to 0.25 Vrms on the meter. Push the SINAD button and check that the meter reads 0 dB ± 1dB. If not, connect the (clip lead-BNC) cable from Test Point 3 on the A8 to the audio analyzer, and check that the voltage on this point is 180mVrms ± 2mV. This level is set by R96 on the A5 [DIST. ADJ]. Disconnect the clip lead cable.

B) Temporarily turn off the 3kHz tone by pressing the Cont button "out", and return the meter to Volt function. Push the fixed 1 kHz button "in", and adjust the knob for a reading of 1 Vrms on the meter. Push the SINAD button "in", and check that the meter reads ≤ -28 dB. If not, adjust R91 [NOTCH] and R94 [NOTCH] alternately to obtain the lowest possible meter reading.

C) Connect a BNC tee-adapter to the Ext/Vert jack so that cables are connected from Mod Out to Ext/Vert and Ext/Vert to the analyzer input. Set the audio analyzer for SINAD, Freq, 1 kHz. Push the Cont button "in" to add 3 kHz,and check that analyzer and 3100 meter both read -12 dB. If not, slightly adjust the 3 kHz audio knob for a reading of -12 dB on the analyzer, then check that the 3100 meter reads -12 dB ±0.5 dB. Set the audio level knob for -5dB and -20dB readings on the audio analyzer, and check that the 3100 measurement falls within ±1dB at each setting. If the 3100 requires adjustment repeat steps 1 and 2 below until the SINAD readings meet specifications.

1) Set the 3 kHz audio kob for a reading of -5dB on the audio analyzer and adjust R52 [dB GAIN] on the A8 for -5 dB meter reading.

2) Set the 3 kHz audio knob for a reading of -20 dB on the analyzer, and adjust R5 [0 dB] on the A8 for -20 dB meter reading.

6.7.18 EXT MODULATION

Disconnect all cables, and reconnect the (clip lead-BNC) cable from Test Point 3 on the A8 to the analyzer input. Set up the analyzer for Volts, 1 kHz at 1 Vrms, and connect a cable from the output to the Ext Mod jack. Enter Gen, on the 3100 keyboard and push the FM, Mod, and "6" buttons. Turn off both internal modulation tones. Adjust the Ext Mod knob for a reading of 106m Vrms on the analyzer. The meter should show 5 ±0.2 kHz. With 106m Vrms at Test Point 3, adjust R55 [PEAK] for 5 kHz. Disconnect all cables.

[END OF AUDIO TESTS]

6.7.19 TIME BASE

Enter 952.35 MHz, Rcv, on the 3100 keyboard. Set up the (Signal Generator) to 952.35 MHz with no modulation. The generator should be locked to a WWV standard. Connect a cable from the generator to the Ant jack on the 3100, and enter Freq Err on the keyboard. The LCD should display a frequency error less than ±50 Hz.

Alternate method, connect a cable from the Rear Panel 10 MHz jack to a (Frequency Counter) set to 1 Hz resolution range. The counter should have a time base accuracy of ±.5 p.p.m. The 10 MHz frequency should be within ± 1 Hz. The TCXO (OXCO) located on the A6 board can be adjusted with a non-metallic tool. (The OCXO adjustment hole is covered by a protective screw.) Adjust for lowest possible frequency error. (Replace protective screw.)

6.7.20 FM RECEIVE

Enter 152.35 MHz on the 3100 keyboard, and push the Bandwidth button in for "Nar" mode. Set the signal generator to 152.34 MHz with 5 kHz FM (1 kHz tone). Set the generator RF level to -20 dB, and connect it to the (Modulation Analyzer) to verify that the modulation level is 5 kHz = 3.54 avg. Now connect the generator to the 3100 Ant jack and check the squelch is "open" and the squelch LED is "on". The 3100 meter should read 5 kHz ±0.2. To adjust this setting, it will be necessary to reach R159 [FM] on the A2 through its module cover, or use the (44 pin Card Extender) to operate the A2 in a raised position.

6.7.21 ØM RECEIVE

Push the Ø button, and verify that the generator is set at 5 Rad = 5 kHz FM (at 1 kHz only). Check the 3100 meter for a 5 Rad reading. This reading is dependent on the A2 FM setting. The adjustment for ØM Rcv is R58 on the A10 board.

6.7.22 AM RECEIVE

Push the AM button, and set the generator to 50% AM (1 kHz). Verify this level with the modulation analyzer. Reconnect the generator to the 3100 and lower the RF level to -50 dBm. The meter should read 50% ± 3%. The AM adjustment is R166 on the A2 board (also controls SSB reading). It can only be adjusted with the circuit board extended from its slot while in operation.

6.7.23 SSB RECEIVE

Push the SSB and "18" buttons. Move the generator carrier frequency up or down 1 kHz, and turn off the modulation. Then check that a 1 kHz tone is audible, and the 3100 meter reads approximately 70 to 100%. This meter reading is related to the AM adjustment and is not critical.

6.7.24 SCAN, DOT MARKER

Enter RF freq, 52.34, MHz on the 3100 keyboard. Set the signal generator to 52.34 MHz without modulation. The RF level should be -50 dBm. Push the -30 [REF LVL dBm] button, and turn the Scan Width knob to the "Nar" position. Connect the generator to the Ant jack. Enter Freq Err on the keyboard and check that freq, error is less than 1 kH. If not, readjust the generator frequency. Press the ON [SCAN MODE] button "in". The scan display should appear on the 3100 oscilloscope and the signal peak should touch the -20 dB line ± 2dB which indicates a -50 dBm signal level. Now press the Marker button "in". The dot marker should appear on the peak of the tuned signal. Adjust the Scan Width knob clockwise to the "Wide" position. The dot should remain atop the signal peak. If not, carefully adjust R42 [Marker Calib] on the A7 to center the dot.

Press the On [SCAN MODE] button "out". Return the Scan Width knob to the "Nar" position. Enter 952.34 MHz on the keyboard and set the generator to 952.34 MHz. The frequency error should be less than 1 kHz. If not, readjust the generator frequency. Press the On button "in" and check that the dot marker appears atop the tuned signal peak. To move the dot to the peak, adjust R106 [MKR] on the A3 board. This is located on the top of the A3 toward the rear of the unit.

6.7.25 SCAN, LOG AMP GAIN

Enter 152.34 MHz on the keyboard, and press the Marker button "out". Set the generator to 52.34 MHz. Verify that the generator output level can make accurate 10 dB steps from -100 dBm to +10 dBm with the (Spectrum Analyzer). Set the generator output level to -90 dBm and connect to the Ant jack. The signal peak should touch the -60 dB line ±2dB. Increase the generator level to -40 dBm; the peak should touch the -10 dB line ±2 dB. To adjust this ratio, set the generator to -90 dBm and note the relative peak position. Increase the level to -40 dBm, and adjust R4 [A GAIN] on the A7 board to make the peak position exactly 50 dB higher than the level at -90 dBm. Now set R7 [OFFSET ADJ] on the A7 to make the signal peak fall exactly on the -10 dB line. It may be necessary to repeat these two steps, as the adjustments tend to interact. Step the generator each 10 dB from -100 to -30 dBm, and verify the signal peak is within ± 2dB at each line.

6.7.26 SCAN, REFERENCE LEVEL STEPS

Push the -10 [REF LVL dBm] button, and set the generator output level to -3 dBm. The signal peak should touch the -20 dB line ± 2 dB.

Push the +10 [REF LVL dBm] button, and set the generator output level to -10 dB line. The signal peak should touch the -20 dB line ± 2 dB. No adjustment.

6.7.27 SCAN WIDTH

Turn the Scan Width knob to the "Nar" position. Offset the generator frequency ±150 kHz, and note that the signal peak moves ±3 divisions right to left ±1 division. The overall Scan Width is adjusted by R164 [SCAN] on the A3 which is only adjustable with the use of the (Extender Card).

6.7.28 SCAN, FREQUENCY RESPONSE

Set the signal generator to -50 dBm and push the -30 [REF LVL] button.
Set the 3100 and signal generator to the following frequencies and check that the tuned signal peak is within the specified level.

2.34 MHz -20 line	± 5 dB
12.34 MHz	± 3 dB
52.34 MHz	± 3 dB
152.34 MHz	± 1 dB
452.34 MHz	± 3 dB
752.34 MHz	± 4 dB
852.34 MHz	± 4 dB
952.34 MHz	± 4 dB

No adjustment.

6.7.29 SQUELCH

Press the On [SCAN MODE] button "out". Set the 3100 and generator to 152.34 MHz. Set the generator level to 0 dBm, and turn the Squelch knob full clockwise "closed". The Squelch LED should go out and no audio heard from the speaker. Disconnect the generator, and turn the Squelch knob full counter-clockwise "open". The Squelch LED should be on and white-noise audio heard from the speaker. The overall squelch sensitivity is a fixed setting.

6.7.30 RF LEVEL, DIAL ACCURACY

Enter Gen, on the 3100 keyboard, and push the following buttons: CW, Mod, X10, mV. Adjust the Output Level dial to 3.0 on the Volts scale. Connect a cable from the RF In/Out jack to the (Spectrum Analyzer). Set the analyzer to 152.34 MHz with frequency span of 1 MHz, so that a 20 dB change can be measured. Note the level of the signal peak on the analyzer, and turn the RF Level dial left to 0.3 on the Volts scale. The signal peak should drop 20 dB ±1 dB on the analyzer display. If not, carefully adjust R27 [OFFSET] located on the top of the A4.

6.7.31 RF LEVEL

Push the X1 and uV buttons, and set the Output Level dial to the 0 dB position. Connect the (Spectrum Analyzer) to its calibration source through the (Pre-Amplifier), and adjust the analyzer reference level so that the analyzer/amplifier system has exactly 20 dB of gain. Set the analyzer to a 2 dB/div. resolution, and connect the 3100 signal. The -100 dBm signal from the 3100 should measure -80 dBm ± 1 dB. If not, carefully adjust R25 [LEVEL] located on top of the A4.

6.7.32 FM GENERATE

Push the X10, mV, FM, and "6" buttons. Connect the RF In/Out cable to the (Modulation Analyzer). Set the modulation analyzer to 152.34 MHz with the bandwidth set at 300 Hz to 3 kHz, and set for FM (avg). Enter Audio Gen, 1, kHz on the 3100 keyboard and press the Cont button "in". Make sure that the fixed 1 kHz button is "out". Adjust the audio level knob for a modulation level of 5 kHz on the 3100 meter. The modulation analyzer should display 3.54 kHz avg. ± 0.15 avg. If necessary, adjust R9 [FM] located on top of the A4.

6.7.33 ØM GENERATE

Set the modulation analyzer to ØM (avg.) and push the ØM button on the 3100. The modulation analyzer should read 3.54 Rad ± 0.2 avg. If necessary adjust R4 [ØM] on the A10 (front panel).

6.7.34 AM GENERATE

Set the modulation analyzer for AM (avg.). Push the AM button on the 3100. The modulation analyzer should read 35.4% ± 1.5% avg. If necessary, adjust R48 [AM] on the A5 (be careful not to adjust R51 [LEVEL] which is located next to the AM pot).

6.7.35 2 TONE

Push the FM button on the 3100 and connect the RF In/Out cable to the Ant jack. Set the modulation level to 1 kHz. Enter Sqlch Code, 2 Tne, Duplx Rcv, Gen Offset, 0, kHz, on the keyboard. Check that a 2 tone code is displayed on the scope and audible from the speaker.

6.7.36 5, 6, 7 TONE

Enter Sqlch Code, 5 Tne, 1 2 3 4 5 6 7, Encode, on the keyboard, and check that the seven tone code is produced.

6.7.37 DTMF

Enter Sqlch Code, DTMF, 0 1 2 3 4 5 6 7 8 9 **, Encde, on the keyboard and check that the DTMF code is produced.

6.7.38 DIGITAL CODE

Enter Sqlch Code, Dig, 025, Encde, on the keyboard. Enter Shift, Subtone, on the keyboard (Digital Decode mode), and check that the LCD displays the Digital Code and the (-INV) code 025/-244. Press the Rcvr button from "Norm" to "Rvs", and check that the Digital code is still displayed as 025/-244 alternately.

6.7.39 WATTS

Push the Watts and "15" buttons, and connect the RF In/Out cable to the (Watt Meter) and (VHF transmitter, 10 watt). Key the transmitter, and check that the 3100 meter reads within [± 7% of the watt meter reading] ± 3% of the 3100 meter full scale. If necessary, adjust R156 [15W] on the bottom of the A4 (the A4 must be operated on the Card Extender fo this adjustment).

Push the "150" button, and connect the wattmeter cable to the (UHF Transmitter, 100 watt). Key the transmitter and check that the 3100 meter reads within [± 7% of the watt meter reading] ± 3% of the 3100 meter full scale. If necessary, adjust R154 [150W] on the bottom of the A4 (the A4 must be operated on the Extender Card for this adjustment).

6.7.40 DC & BATTERY OPTION

Set up the 3100 for operation from the AC line ≈ 117 VAC. Only units factory set for 220 VAC operation should be connected to 220 VAC (the rear panel switch should be set to the Int. position). Power switch "off".

If the 3100 was supplied with the 12V internal battery pack (*optional), turn the unit off and allow at least 1 hour charge time while connected to the AC line. This will guarantee that the battery has reached at least 90% charge to allow measurement of the idel voltage.

With the DVM, measure the DC voltage from E1 (red wire) to E2 (black wire) on the A12. Check the room temperature with the (thermometer) and compare the measured voltage to the list of temperatures below:

Room Temperature Degrees F	D.C. Voltage ± .02V
60	14.37 V
65	14.28 V
70	14.20 V
75	14.12 V
80	14.03 V
85	13.95 V
90	13.86 V

If necessary, carefully adjust R100 on the Compower board, located near the right rear corner of the unit. Turn the unit on and check that the voltage across E1 and E2 drops less than 1V. Unplug the unit from the A.C. line and check that the battery voltage drops less than 1.5V.

Turn the unit off, and set the rear panel switch to the Ext. position. Connect the (D.C. Power Supply) to the rear panel binding posts, observing the correct polarities. Adjust the power supply voltage to 13.8 VDC at E1 and E2 on the A12. Slowly decrease the power supply voltage, and note that the unit operates normally as the voltage drops. At 11.2 VDC ±.05V, the A12 will switch to the Low Volts mode (current draw will increase from 5 amps to 6 amps). If necessary, adjust R23 [H/L Volts] on the A12, mounted to the transformer. Continue to lower the power supply voltage; at 10.9 VDC ± .05 V the LCD should display {Lo Batt} in the upper right corner. If necessary, adjust R4 [Lo Batt] on the A12. Carefully lower the supply voltage until the unit shuts off and note that the voltage was 10.5 VDC ± .05V. If necessary, adjust R12 [CUT OFF] on the A12. It will be necessary to readjust the supply voltage to 11.5 VDC and turn the unit on again, to recheck the cutoff voltage threshold.

[END OF CALIBRATION TESTS]

SECTION 7

REPLACEABLE PARTS

7.1 INTRODUCTION

This section contains lists of all replaceable parts for the instrument.

For an assembly containing one or more subassemblies, the assembly list appears first, and is followed by the subassembly lists.

The lists appear in the following order.

PARTS LIST	ASSEMBLY
1010-70-0002	3100
1111-70-0004	Chassis
1118-70-0005	FP Assembly
1118-70-0006	RP Assembly
1219-70-0003	Line Cord Assy
1110-70-0055	A1
1110-70-0052	A2
1110-70-0066	A3
1110-70-0065	A4
1110-70-0056	A5
1110-70-0057	A6
1110-70-0050	A7
1110-70-0068	A8
1218-70-0001	A9
1110-70-0061	A10
1218-70-0006	A10
1110-70-0067	A11
1110-70-0069	A12
1110-70-0070	A13

7.2 MANUFACTURER'S CODE

The following code is used on the parts lists to identify the manufacturer.

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	Part No.	QTY
ZA01	LOCAL OSC BD,A1,3100	3100-A1	W-I	1110-70-0055	1.000
ZA02	IF AMP BD,A2,3100	3100-A2	W-I	1110-70-0052	1.000
ZA03	RF SYNTH BD,A3,3100	3100-A3	W-I	1110-70-0066	1.000
ZA04	GENERATE BD, A4,3100	3100-A4	W-I	1110-70-0065	1.000
ZA05	AUDIO BD,A5,3100	3100-A5	W-I	1110-70-0056	1.000
ZA06	LV SUPPLY BD,A6,3100	3100-A6	W-I	1110-70-0057	1.000
ZA07	DEFL BD,A7,3100	3100-A7	W-I	1110-70-0050	1.000
ZA08	HV SUPPLY BD,A8,3100	3100-A8	W-I	1110-70-0068	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	Part No.	QTY
W03 W04	CABLE ASSY,14IN	WX3100-C	W-I	1217-80-0095	2.000
W05 W07 W08	CABLE ASSY,5IN	WX3100-A	W-I	1217-80-0093	3.000
W06	CABLE ASSY,7-1/2IN	WX3100-B	W-I	1217-80-0094	1.000

COMTEST PARTS LIST	CHASSIS,3100	1111-70-0004 PAGE: 1	B REV

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	Part No.	QTY
H03 H06	CABLE ASSY,RIBBON F,PANEL INTERFACE	6011-60-0048	W-I	6011-60-0048	2.000
H04	CABLE ASSY,RIBBON LCD JUMPER	6011-60-0044	W-I	6011-60-0044	1.000
H08	HARN, ON/OFF SWITCH	HARN,ON/OFF SWITCH	W-I	1219-70-0031	1.000
R01 R03	POT/SW.50K LIN/SPDT PUSH-PULL	CM44620	CLR	4610-31-8503	2.000
R02	POT/SW. 1K LIN/SPDT NO @ CW	CM44695	CLR	4610-31-7102	1.000
R04	POT/SW.50K LIN/SPDT NO @ CW	CM44621	CLR	4610-31-7503	1.000
R05 R06 R10 R11	POT,10K W/1/8X.5SHFT	CM44625	CLAR	4610-50-6103	4.000
R07	POT,5K,LIN	JA1G040S502UA	A-B	4610-15-3502	1.000
R08-09	POT,DUAL 20% ZTAPER @10K/20% ZTAPER @ 1K	CM44624	CLR	4610-41-0103	1.000
W01 W02	CABLE ASSY, BNC, 12-1/2 IN, W1	WXSSI-3000-WI	W-I	1217-80-0065	2.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	Part No.	QTY
C01 C02	CAP,DISC,3KV,.01UF	DD30-103	C-L	1510-14-0103	2.000
	INTENSITY CONTROL		A-B	4610-15-4505	1.000

COMTEST PARTS LIST	RP ASSY,3100	1118-70-0006 PAGE: 1	B REV

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	Part No.	QTY
1	TERM,FEMALE	02-09-1118	MOL	2113-09-0003	4.000
P101	CORD SET,18/3SVT,6FT BK,MLD,CAP,UL-APPRV	6011-80-0001	ECMC	6011-80-0001	1.000

COMTEST PARTS LIST	LINE CORD AY,3000SSI	1219-70-0003 PAGE: 1	B REV

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	Part No.	QTY
C01 C05 C06 C08 C09 C10 C100 C101 C102 C103 C104 C105 C11 C111 C112 C113 C115 C118 C12 C125 C127 C134 C135 C136 C16 C18 C19 C20 C21 C22 C23 C29 C30 C31 C32 C33 C34 C35 C36 C39 C40 C41 C42 C47 C54 C56 C58 C59 C60 C61 C62 C63 C64 C66 C68 C83 C90 C98 C99	CAP,MON,50V,.01UF	CW15C103K	C-L	1510-14-4103	59.000
C02	CAP,MON,50V,180PF	RA50-181JA	MURGA	1510-11-8181	1.000
C03	CAP,MON,50V,150PF	RA50-151JA	MURGA	1510-11-8151	1.000
C04	CAP,MON,50V,100PF	RA50-101JA	MURGA	1510-11-8101	1.000
C13 C55	CAP,MICA,500V,50PF	DM15-500J	ARC	1510-50-0500	2.000
C14	CAP,COMP,500V,3.6PF	QC-3.6PF	Q-C	1510-40-0369	1.000
C15	CAP,COMP,500V,2.7PF	QC-2.7PF	Q-C	1510-40-0279	1.000
C17 C53 C86	CAP,MON,50V,56PF	RA50-560JA	MURGA	1510-11-8560	3.000
C24 C25 C26 C27 C28	CAP,CHIP,.1 UF	51C1209-B104Z	CFI	1510-00-3104	5.000
C37 C48	CAP,MON,50V,15PF	1006-0151	SSI	1510-11-8150	2.000
C38	CAP,MICA,500V,62PF	DM15-620J	ARC	1510-50-0620	1.000
C43 C89	CAP,MON,50V,68PF	RA50-680JA	MURGA	1510-11-8680	2.000
C44	CAP,MICA,500V,240PF	DM15-241J	ARC	1510-50-0241	1.000
C45 C51 C52 C69	CAP,DISC,.05UF	UK25-503	C-L	1510-14-1503	4.000
C49 C50	CAP,ELEC,6.3V,100UF	20ZE100	RBYCN	1510-27-5102	2.000
C79	CAP,MON,50V,5.6PF	C312C569D2G5CA	UNCAR	1510-11-8569	1.000
C80	CAP,MON,50V,2.2PF	C312C229D2G5CA	UNCAR	1510-11-8229	1.000
C82	CAP,VAR,18PF	GKU18000	SPR	1510-71-4180	1.000
C84	CAP,MICA,500V,200PF	DM15-201J	S-F	1510-50-0201	1.000
C85	CAP,MON,50V,330PF	RA50-331JA	MURGA	1510-11-8331	1.000
C87 C97	CAP,FILM,63V,.047UF	168/.047/K/63/A	WSTLK	1510-63-9473	2.000
C88	CAP,TANT,35V,2.2 UF	196D225X9035JA1	SPR	1510-25-3229	1.000
C95	CAP,MON,50V,.0047UF	CN30C472K	CRL	1510-11-8472	1.000
C96	CAP,MON,50V,.0018UF	CN30A182K	CRL	1510-11-8182	1.000
C106 C108 C114 C65	CAP,MON,50V,.0033UF	RPE122C0G332J50V	MURGA	1510-11-8332	4.000
C107 C122	CAP,MON,50V,.22UF	8131-050-151-224M	ETP	1510-14-6224	2.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	Part No.	QTY
C109 C117 C87 C91 C94	CAP,TANT,20V,10UF	196D106X9020JA1	SPR	1510-25-2100	5.000
C110 C129	CAP,MON,50V,33PF	RA50-330JA	MURGA	1510-11-8330	2.000
C116	CAP,MON,50V,.01UF	CN30C103K	CRL	1510-11-8103	1.000
C119	CAP,MON,50V,.022UF	RA50-223D	MURGA	1510-11-8223	1.000
C120 C131 C133	CAP,MON,50V,82PF	RA50-820JA	MURGA	1510-11-8820	3.000
C121 C123 C57 C93	CAP,TANT,35V,1UF	196D105X9035HA1	SPR	1510-25-3109	4.000
C124	CAP,TANT,35V,4.7UF	196D475X9035JA1	SPR	1510-25-3479	1.000
C126 C92	CAP,MON,100V,470PF	CW15A471M	C-L	1510-14-5471	2.000
C128 C130	CAP,MON,50V,18PF	C312C180J2G5CA	UNCAR	1510-11-8180	2.000
C132	CAP,MON,50V,120PF	RA50-121JA	MURGA	1510-11-8121	1.000
C138 C139	CAP,COMP,500V,.62PF	QC-.62PF	Q-C	1510-40-0628	2.000
C140	CAP,ELEC,16V,470UF	ECEB1CV471S	PNSNC	1510-25-8471	1.000
CR01	DIODE, SIGNAL STATIC SENSITIVE ‡2	HSCH1001	H-P	4807-01-6263	1.000
CR02 CR03 CR11 CR12 CR13 CR14 CR15 CR16 CR24 CR25 CR26 CR27 CR28 CR29 CR30	DIODE, VARACTOR STATIC SENSITIVE ‡2	1N5767	HP	4803-02-0018	15.000
CR05 CR17	DIODE,VARACTOR STATIC SENSITIVE ‡2	BB405B	APX	4803-02-0011	2.000
CR06 CR18 CR19 CR20 CR21 CR22 CR23	DIODE,SIGNAL STATIC SENSITIVE ‡2	1N914	G-E	4807-01-0914	7.000
CR07 CR08 CR09 CR10	DIODE, SIGNAL STATIC SENSITIVE ‡2	1N4444	UNIT	4807-01-4444	4.000
J01 J02 J03 J04 J05	CONN,RF,STR,JACK	700209	CBLWV	2110-08-0006	5.000
L01	CHOKE,MOLDED,.33 UH	1025-08	DEL	1810-10-0338	1.000
L02 L03	CHOKE,MOLDED,0.56UH	1025-14	DEL	1810-10-0568	2.000
L04 L05 L14	CHOKE,MOLDED,39 UH	1025-58	DEL	1810-10-0390	3.000
L06 L33	COIL,AIR,22GA,5T	1815-00-0123	W-I	1815-00-0123	2.000
L07 L08 L26 L28 L30	CHOKE,MOLDED,100 UH	1025-68	DEL	1810-10-0101	5.000
L09 L16 L17	CHOKE,MOLDED,0.12 UH	1025-96	DEL	1810-10-0128	3.000
L10	COIL,VAR,2-1/2 T FROM:1813-00-0046	1210-32-0029	W-I	1210-32-0029	1.000
L11 L12 L13	COIL,VAR,1.01/1.18UH	Y3353-N3	MURA	1811-00-0006	3.000
L15	CHOKE,MOLDED,0.1 UH	1025-94	DEL	1810-10-0108	1.000
L18 L19 L20	CHOKE	VK20010/3B	FRXC	1810-09-0001	3.000
L25	CHOKE,MOLDED,5.6 UH	1025-38	DEL	1810-10-0569	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	Part No.	QTY
Q05 - See Page 6					
L27 L32	COIL,AIR,22GA,3T	1815-00-0122	W-I	1815-00-0122	2.000
L29 L31	CHOKE,MOLDED,.18UH	10/180	GWNDA	1810-10-0188	2.000
M01 M02 M03	MIXER,DBL.BAL.	SBL-1-DBL	MIN-C	3010-54-0004	3.000
M04	MIXER,DBL.BAL.	TFM-2-DBL	MIN-C	3010-54-0005	1.000
Q01 Q02	TRANSISTOR STATIC SENSITIVE ‡2	A400	APX	4902-00-4000	2.000
Q04 Q08 Q09 Q10 Q12	TRANSISTOR STATIC SENSITIVE ‡2	PN4121-18	NAT	4901-04-1210	5.000
Q06 Q07	TRANS QA035-630 STATIC SENSITIVE ‡2	2N3563	FCD	4901-03-5630	2.000
R01	RES,C,1/4W,5%,110K	CF1/4-110K	ASE	4700-15-1103	1.000
R02 R25 R30 R33 R55 R57	RES,C,1/4W,5%,1K	CF1/4-1K	ASE	4700-15-1001	6.000
R03 R128	RES,C,1/4W,5%,47	CF1/4-47	ASE	4700-15-4709	2.000
R04	RES,C,1/4W,5%,300	CF1/4-300	ASE	4700-15-3000	1.000
R05 R115	RES,C,1/4W,5%,51	CF1/451	ASE	4700-15-5109	2.000
R06	RES,C,1/4W,5%,75	CR1/4-75	ASE	4700-15-7509	1.000
R07 R18 R26	RES,C,1/4W,5%,1.2K	CF1/4-1.2K	ASE	4700-15-1201	3.000
R08 R113 R129	RES,C,1/4W,5%,100	CF1/4-100	ASE	4700-15-1000	3.000
R09	RES,C,1/4W,5%,12	CF1/4-12	ASE	4700-15-1209	1.000
R10	RES,C,1/2W,5%,820	CF1/2-820	ASE	4700-25-8200	1.000
R11 R48 R52	RES,C,1/4W,5%,6.8K	CF1/4-6.8K	ASE	4700-15-6801	3.000
R12	RES,C,1/4W,5%,750	CF1/4-750	ASE	4700-15-7500	1.000
R13 R35 R59 R64	RES,C,1/4W,5%,390	CF1/4-390	ASE	4700-15-3900	4.000
R14 R92	RES,C,1/4W,5%,8.2K	CF1/4-8.2K	ASE	4700-15-8201	2.000
R15 R20	RES,C,1/8W,5%,270	CF1/8-270	ASE	4700-05-2700	2.000
R16 R21 R32 R34 R42 R43 R47 R66 R70	RES,C,1/4W,5%,68	CF1/4-68	ASE	4700-15-6809	9.000
R17	RES,C,1/4W,5%,47K	CF1/4-47K	ASE	4700-15-4702	1.000
R19	RES,C,1/8W,5%,18	CF1/8-18	ASE	4700-05-1809	1.000
R22 R46 R51 R94	RES,C,1/4W,5%,820	CF1/4-820	ASE	4700-15-8200	4.000
R23	RES,C,1/4W,5%, 2.4K	CF1/4-2.4K	ASE	4700-15-2401	1.000
R24 R65	RES,C,1/4W,5%,510	CF1/4-510	ASE	4700-15-5100	2.000
R27	RES,C,1/4W,5%,33K	CF1/4-33K	ASE	4700-15-3302	1.000
R28 R49 R53	RES,C,1/4W,5%,5.6K	CF1/4-5.6K	ASE	4700-15-5601	3.000
R122 - See Page 6					

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	Part No.	QTY
R110 - See Page 6					
R29 R31	RES,C,1/4W,5%,1.1K	CF1/4-1.1K	ASE	4700-15-1101	2.000
R44	RES,C,1/4W,5%,82	CF1/4-82	ASE	4700-15-8209	1.000
R50 R54 R58	RES,C,1/4W,5%,330	CF1/4-330	ASE	4700-15-3300	3.000
R56	RES,C,1/4W,5%,2.7K	CF1/4-2.7K	ASE	4700-15-2701	1.000
R60	RES,C,1/4W,5%,220	CF1/4-220	ASE	4700-15-2200	1.000
R62 R87	RES,C,1/4W,5%,3K	CF1/4-3K	ASE	4700-15-3001	2.000
R71	RES,MF,1/8W,1%,84.5	RN55D-84.5	MILSP	4701-03-8459	1.000
R74	RES,C,1/4W,5%,24K	CF1/4-24K	ASE	4700-15-2402	1.000
R82	RES,C,1/4W,5%,6.2K	CF1/4-6.2K	ASE	4700-15-6201	1.000
R83	RES,C,1/4W,5%,15K	CF1/4-15K	ASE	4700-15-1502	1.000
R88	RES,C,1/4W,5%,1M	CF1/4-1M	ASE	4700-15-1004	1.000
R89	RES,C,1/4W,5%,3.3K	CF1/4-3.3K	ASE	4700-15-3301	1.000
R95	RES,C,1/4W,5%,3.6K	CF1/4-3.6K	ASE	4700-15-3601	1.000
R96	RES,MF,1/8W,1%,453K	RN55D-453K	MILSP	4701-03-4533	1.000
R97	RES,MF,1/8W,1%,243K	RN55D-243K	MILSP	4701-03-2433	1.000
R99	RES,MF,1/8W,1%,158K	RN55D-158K	MILSP	4701-03-1583	1.000
R100	RES,MF,1/8W,1%,475K	RN55D-475K	MILSP	4701-03-4753	1.000
R101 R45	RES,C,1/4W,5%,2.2K	CF1/4-2.2K	ASE	4700-15-2201	2.000
R102 R108 R36 R37 R38 R39 R40 R41 R63 R67 R68 R69 R75	RES,C,1/4W,5%,10K	CF1/4-10K	ASE	4700-15-1002	13.000
R103 R109 R111	RES,C,1/4W,5%,16K	CF1/4-16K	ASE	4700-15-1602	3.000
R104 R105 R106 R107 R116 R117 R73 R91 R98	RES,MF,1/8W,1%,100K	RN55D-100K	MILSP	4701-03-1003	9.000
R112 R90	RES,C,1/4W,5%,470	CF1/4-470	ASE	4700-15-4700	2.000
R114	RES,C,1/4W,5%,3.9	CF1/4-3.9	ASE	4700-15-3908	1.000
R118 R72 R93	RES,C,1/4W,5%,22K	CF1/422K	ASE	4700-15-2202	3.000
R119	RES,MF,1/8W,1%,237K	RN55D-237K	MILSP	4701-03-2373	1.000
R120	RES,C,1/4W,5%,10	CF1/4-10	ASE	4700-15-1009	1.000
R121	RES,MF,1/8W,1%,182K	RN55D-182K	MILSP	4701-03-1823	1.000
R123	RES,C,1/4W,5%,100K	CF1/4-100K	ASE	4700-15-1003	1.000
R124	POT,100	3386W-1-101	BOU	4610-02-0101	1.000
RT01	THRMSTR,500	CA25J1	FWL	5310-00-0005	1.000
T01	XFMR, BIFILAR	1501-0001	SSI	1210-43-0011	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	Part No.	QTY
TP01	TESTPOINTS-	2520B-1	USECO	2112-19-0005	1.000
U01 U03	AM/FM DIG PLL SYNTH STATIC SENSITIVE	DS8906	NAT	8000-89-0600	2.000
U02 U08 U09 U14 U15	DUAL OP AMP STATIC SENSITIVE ‡2	TL082CP	T-I	7000-00-8200	5.000
U07	HI-SPEED PRESCALER STATIC SENSITIVE	CA3179	RCA	8001-20-7100	1.000
U10	MONO/ASTABLE MLTVBTR STATIC SENSITIVE	CD4047BC	NAT	8000-40-4710	1.000
U11 U12	IC,IL004-001 STATIC SENSITIVE ‡2	LM339N	NAT	7000-03-3900	2.000
U13	OP AMP STATIC SENSITIVE ‡2	LF351N	NAT	7000-00-8100	1.000
U16 - See Page 6					
R132, R135 - See Page 6					
R131, R133, R134, R136 - See Page 6					

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG MFGR PART NO	MFGR	PART NUMBER	QTY
Q05	JFET, N CHAN	2N4416	NAT	4901-04-4160	1.000
R122	RES, 1/4W, 5%, 120	CF1/4-120	ASE	4700-15-1200	1.000
R110	RES, C, 1/4W, 5%, 9.1K	CF1/4-9.1K	ASE	4700-15-9101	1.000
U16	WIDE BAND AMP	MWA320	MOT	7000-03-2000	1.000
R132, R135	RES, C, 1/8W, 1%, 221	RN55D-221	MILSP	4711-03-2210	2.000
R131, R133, R134, R136	RES, C, 1/8W, 1%, 61.6	RN55D-61.6	MILSP	4711-03-6169	4.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	PART NO.	QTY
C01 C100 C113 C115 C122 C24 C47 C50 C57 C58 C59 C61 C91 C92 C93 C96 C97	CAP,MON,50V,.22UF	8131-050-151-224M	ETP	1510-14-6224	17.000
C02	CAP,MON,50V,1UF	3420-050-E105M	AER	1510-11-3105	1.000
C03 C04 C08 C09 C118 C126 C127 C130 C132 C136 C137 C20 C22 C38 C41 C42 C43 C44 C45 C46 C53 C55 C56 C94 C99	CAP,MON,50V,.01UF	CW15C103K	C-L	1510-14-4103	25.000
C05 C10	CAP,MICA,500V,1500PF	DM19-152J	ARC	1510-50-0152	2.000
C06	CAP,MON,50V,82PF	RA50-820JA	MURGA	1510-11-8820	1.000
C07 C15 C98	CAP,MON,100V,470PF	CW15A471M	C-L	1510-14-5471	3.000
C11	CAP,MICA,500V,82PF	CM05ED820J03	SPR	1510-50-0820	1.000
C12	CAP,MON,50V,39PF	RA50-390JA	MURGA	1510-11-8390	1.000
C18 C28 C32	CAP,MON,50V,120PF	RA50-121JA	MURGA	1510-11-8121	3.000
C021 C110	CAP,MON,50V,390PF	RA50-391JA	MURGA	1510-11-8391	2.000
C26 C31	CAP,MON,50V,270PF	RA50-271JA	MURGA	1510-11-8271	2.000
C27 C29	CAP,COMP,500V,2.4PF	QC-2.4PF	Q-C	1510-40-0249	2.000
C33	CAP,MON,50V,8.2PF	C312C829D2G5CA	UNCAR	1510-11-8829	1.000
C35	CAP,MON,50V,27PF	RA50-270JA	MURGA	1510-11-8270	1.000
C48 C52	CAP,MON,50V,560PF	RA50-561JA	MURGA	1510-11-8561	2.000
C049 C112	CAP,MON,50V,100PF	RA50-101JA	MURGA	1510-11-8101	2.000
C60, C129	CAP,MON,50V,.0047UF	CN30C472K	CRL	1510-11-8472	2.000
C90	CAP,MON,50V,15PF	1006-0151	SSI	1510-11-8150	1.000
C101 C108 C13 C131 C16 C17 C19 C34 C36 C37 C40 C65 C67 C71 C73 C74 C78 C80 C81 C85 C88	CAP,TANT,35V,1UF	196D105X9035HA1	SPR	1510-25-3109	21.000
C102 C30	CAP,MON,50V,150PF	RA50-151JA	MURGA	1510-11-8151	2.000
C103	CAP,TANT,35V,4.7UF	196D475X9035JA1	SPR	1510-25-3479	1.000
C104 C139	CAP,MON,50V,18PF	C312C180J2G5CA	UNCAR	1510-11-8180	2.000
C105	CAP,MON,50V,.0082UF	CN30C822K	CRL	1510-11-8822	1.000
C106	CAP,MON,50V,.001UF	RPE122C0G102J50N	MURGA	1510-11-8102	1.000
C107 C133 C64	CAP,DISC,.05UF	UK25-503	C-L	1510-14-1503	3.000
C109	CAP,MON,50V,.0068UF	CN30C682K	CRL	1510-11-8682	1.000
C111 C143	CAP,MON,50V,.0027UF	RA50-272JB	MURGA	1510-11-8272	2.000
C114	CAP,MICA,500V,510PF	DM-15-511J	ARC	1510-50-0511	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	PART NO.	QTY
C116 C140	CAP,ELEC,16V,100UF	20YH100	MOUS	1510-27-6101	2.000
C117	CAP,DISC,1KV,.001UF	5GAD10	SPR	1510-10-1102	1.000
C119 C123 C23 C51 C54 C95	CAP,TANT,35V,2.2 UF	196D225X9035JA1	SPR	1510-25-3229	6.000
C120	CAP,CER,N750,100PF	CMN750-1015	RMC	1510-11-7101	1.000
C121	CAP,ELEC,16V,470UF	ECEB1CV471S	PNSNC	1510-25-8471	1.000
C124	CAP,MON,50V,180PF	RA50-181JA	MURGA	1510-11-8181	1.000
C125 C39 C63 C66 C68 C69 C70 C72 C75 C76 C77 C79 C82 C83 C84 C87 C89	CAP,DISC,.01UF	UK25-103	C-L	1510-14-1103	17.000
C128 C134 C135 C138 C14 C62 C86	CAP,TANT,20V,10UF	196D106X9020JA1	SPR	1510-25-2100	7.000
C141 C25	CAP,MON,50V,10PF	RA50-100DA	MURGA	1510-11-8100	2.000
CR01 CR02 CR03 CR04 CR05 CR06 CR07 CR08 CR09 CR10 CR11 CR12 CR13 CR14 CR18 CR19 CR20 CR21	DIODE,SIGNAL STATIC SENSITIVE #2	1N914	G-E	4807-01-0914	18.000
CR15 CR16 CR17	DIODE, SIGNAL STATIC SENSITIVE #2	HSCH1001	H-P	4807-01-6263	3.000
J01	CONN,RF,STR,JACK	700209	CBLWV	2110-08-0006	1.000
L01 L02	COIL,VAR,76/109 UH	Y3353-N2	MURA	1811-00-0005	2.000
L03 L04	COIL,VAR,1.01/1.18UH	Y3353-N3	MURA	1811-00-0006	2.000
L05	CHOKE,MOLDED,82 UH	1537-72	DEL	1810-10-0820	1.000
L06 L07 L08	COIL,VAR,300-360UH	06239	BELL	1811-00-0015	3.000
L09 L10 L11 L12 L13 L14 L15 L16 L17	CHOKE,MOLDED,5.6MILH RF SHIELDED	1641-565	DEL	1810-10-0564	9.000
L18	CHOKE,MOLDED,100 UH	1025-68	DEL	1810-10-0101	1.000
L19 L20 L21 L22	CHOKE	VK20010/3B	FRXC	1810-09-0001	4.000
L23	CHOKE,MOLDED,180 UH	1025-74	DEL	1810-10-0181	1.000
L24	CHOKE,MOLDED,4.7UH	10/471	GWNDA	1810-10-0479	1.000
Q01 Q02	TRANS QA035-630 STATIC SENSITIVE #2	2N3563	FCD	4901-03-5630	2.000
Q03 Q04 Q06 Q07 Q08 Q09 Q10 Q12 Q13	TRANSISTOR STATIC SENSITIVE #2	PN2222	NAT	4901-02-2220	9.000
Q05	TRANSISTOR STATIC SENSITIVE #2	PN4121-18	NAT	4901-04-1210	1.000
Q11	XSTOR,DUALGATE STATIC SENSITIVE	3N201	T-I	4903-00-2010	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	PART NO.	QTY
Q14	TRANSISTOR STATIC SENSITIVE #2	2N5949	NAT	4901-05-9490	1.000
R01 R133	RES,C,1/4W,5%,27K	CF1/4-27K	ASE	4700-15-2702	2.000
R02	RES,C,1/4W,5%,62K	CF1/4-62K	ASE	4700-15-6202	1.000
R03 R166 R188	POT,10K	3386W-1-103	BOU	4610-02-0103	3.000
R04 R141 R144 R174	RES,C,1/4W,5%,75K	CF1/4-75K	ASE	4700-15-7502	4.000
R05 R06 R09 R138 R151 R153 R156 R157 R158 R177 R18 R183 R190 R193 R195 R199 R50 R62 R68 R69	RES,C,1/4W,5%,10K	CF1/4-10K	ASE	4700-15-1002	20.000
R07	RES,C,1/4W,5%,2.7K	CF1/4-2.7K	ASE	4700-15-2701	1.000
R08 R143 R70	RES,C,1/4W,5%,390K	CF1/4-390K	ASE	4700-15-3903	3.000
R10 R24 R28	RES,C,1/4W,5%,4.7K	CF1/4-4.7K	ASE	4700-15-4701	3.000
R11 R149 R155 R75	RES,C,1/4W,5%,2K	CF1/4-2K	ASE	4700-15-2001	4.000
R12	RES,C,1/4W,5%,1.2M	CF1/4-1.2M	ASE	4700-15-1204	1.000
R13	RES,C,1/4W,5%,360K	CF1/4-360K	ASE	4700-15-3603	1.000
R14	RES,C,1/4W,5%,200K	CF1/4-200K	ASE	4700-15-2003	1.000
R15 R76	RES,C,1/4W,5%,9.1K	CF1/4-9.1K	ASE	4700-15-9101	2.000
R19	RES,C,1/4W,5%,18K	CF1/4-18K	ASE	4700-15-1802	1.000
R21 R27	RES,C,1/4W,5%,5.6K	CF1/4-5.6K	ASE	4700-15-5601	2.000
R22 R26	RES,C,1/4W,5%,1.2K	CF1/4-1.2K	ASE	4700-15-1201	2.000
R23 R25	RES,1/4W 5%,39	CF-1/4-39	ASE	4700-15-3909	2.000
R32	RES,C,1/4W,5%,560	CF1/4-560	ASE	4700-15-5600	1.000
R34 R57	POT,500	3386W-1-501	BOU	4610-02-0501	2.000
R35 R51	RES,C,1/4W,5%,2.2K	CF1/4-2.2K	ASE	4700-15-2201	2.000
R37	RES,C,1/4W,5%,51	CF1/451	ASE	4700-15-5109	1.000
R38 R52	RES,C,1/4W,5%,510	CF1/4-510	ASE	4700-15-5100	2.000
R40	RES,C,1/4W,5%,33	CF1/4-33	ASE	4700-15-3309	1.000
R43	RES,MF,1/8W,1%,487	RN55D-487	MILSP	4701-03-4870	1.000
R45	RES,C,1/4W,5%,39K	CF1/4-39K	ASE	4700-15-3902	1.000
R49	RES,MF,1/8W,1%,681	RN55D-681	MILSP	4701-03-6810	1.000
R53 R55 R60 R65	RES,C,1/4W,5%,220K	CF1/4220K	ASE	4700-15-2203	4.000
R56 R59	RES,C,1/4W,5%,390	CF1/4-390	ASE	4700-15-3900	2.000
R66	RES,MF,1/8,1%,1.37K	RN55D-1.37K	MILSP	4701-03-1371	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	PART NO.	QTY
R67	RES,MF,1/8W,1%,8.66K	RN55D-8.66K	MILSP	4701-03-8661	1.000
R71	RES,C,1/4W,5%,180K	CF1/4-180K	ASE	4700-15-1803	1.000
R72	POT,100K	3386W-1-104	BOU	4610-02-0104	1.000
R74	POT,5K	3386W-1-502	BOU	4610-02-0502	1.000
R81	RES,MF,1/8W,1%,1.33K	RN55D-1.33K	MILSP	4701-03-1331	1.000
R90	RES,MF,1/8W,1%,10.7K	RN55D-10.7K	MILSP	4701-03-1072	1.000
R100 R108 R110 R111 R115 R116 R121 R124 R125 R126 R127 R77 R82 R83 R84 R87 R94 R95 R97 R99	RES,MF,1/8W,1%,1K	RN55D-1K	MILSP	4701-03-1001	20.000
R101 R109 R117 R122 R128 R79 R88 R96	RES,MF,1/8W,1%,19.1K	RN55D-19.1K	MILSP	4701-03-1912	8.000
R102 R112 R118 R129 R85 R89 R98	RES,MF,1/8W,1%,4.75K	RN55D-4.75K	MILSP	4701-03-4751	7.000
R103 R107 R114 R78 R91	RES,MF,1/8W,1%,16.2K	RN55D-16.2K	MILSP	4701-03-1622	5.000
R104 R105 R113 R130 R86 R92	RES,MF,1/8W,1%,1.50K	RN55D-1.50K	MILSP	4701-03-1501	6.000
R106 R123 R80 R93	RES,MF,1/8W,1%,3.32K	RN55D-3.32K	MILSP	4701-03-3321	4.000
R119	RES,MF,1/8W,1%,1.54K	RN55D-1.54K	MILSP	4701-03-1541	1.000
R120	RES,MF,1/8W,1%,17.4K	RN55D-17.4K	MILSP	4701-03-1742	1.000
R131	RES,MF,1/8W,1%,7.5K	RN55D-7.5K	MILSP	4701-03-7501	1.000
R132	RES,MF,1/8W,1%,15K	RN55D-15K	MILSP	4701-03-1502	1.000
R134 R167 R31	RES,C,1/4W,5%,12K	CF1/4-12K	ASE	4700-15-1202	3.000
R135 R187 R42 R48	RES,C,1/4W,5%,5.1K	CF1/4-5.1K	ASE	4700-15-5101	4.000
R136	RES,C,1/4W,5%,3.3M	CF1/4-3.3M	ASE	4700-15-3304	1.000
R137 R139 R140	RES,C,1/4W,5%,33K	CF1/4-33K	ASE	4700-15-3302	3.000
R142 R148 R29 R30 R39 R41 R44	RES,C,1/4W,5%,20K	CF1/4-20K	ASE	4700-15-2002	7.000
R145 R146 R147 R182	RES,C,1/4W,5%,2.2M	CF1/4-2.2M	ASE	4700-15-2204	4.000
R150 R154 R33	RES,C,1/4W,5%,200	CF1/4-200	ASE	4700-15-2000	3.000
R152 R16 R17 R184 R189 R194	RES,C,1/4W,5%,22	CF1/4-22	ASE	4700-15-2209	6.000
R159	POT,50K	3386W-1-503	BOU	4610-02-0503	1.000
R160	RES,C,1/4W,5%,51K	CF1/4-51K	ASE	4700-15-5102	1.000
R161	RES,MF,1/8W,1%,698K	RN55D-698K	MILSP	4701-03-6983	1.000
R162 R163	RES,MF,1/8W,1%,3.48K	RN55D-3.48K	MILSP	4701-03-3481	2.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	PART NO.	QTY
R164 R197 R20 R54	RES,C,1/4W,5%,270	CF1/4-270	ASE	4700-15-2700	4.000
R165 R185 R198 R200 R203 R36 R61 R63 R64	RES,C,1/4W,5%,1K	CF1/4-1K	ASE	4700-15-1001	9.000
R168 R175 R186	RES,C,1/4W,5%,100	CF1/4-100	ASE	4700-15-1000	3.000
R169	RES,C,1/4W,5%,8.2K	CF1/4-8.2K	ASE	4700-15-8201	1.000
R170 R180	RES,C,1/4W,5%,100K	CF1/4-100K	ASE	4700-15-1003	2.000
R171 R172 R173	RES,MF,1/8W,1%,4.12K	RN55D-4.12K	MILSP	4701-03-4121	3.000
R176	RES,C,1/4W,5%,3.6K	CF1/4-3.6K	ASE	4700-15-3601	1.000
R178	RES,C,1/4W,5%,750	CF1/4-750	ASE	4700-15-7500	1.000
R179	RES,C,1/4W,5%,1.5M	CF1/4-1.5M	ASE	4700-15-1504	1.000
R181	RES,C,1/4W,5%,13K	RCF-13K-QB	CII	4700-15-1302	1.000
R191 - See Page 7					
R192 - See Page 7					
R196	RES,C,1/4W,5%,1M	CF1/4-1M	ASE	4700-15-1004	1.000
R201 R202 R47	RES,C,1/4W,5%,10	CF1/4-10	ASE	4700-15-1009	3.000
R204 R58 R73	RES,C,1/4W,5%,150	CF1/4-150	ASE	4700-15-1500	3.000
RT01	THRMSTR,1K	CA31J1	FWL	5310-00-0006	1.000
TP01 TP02 TP03 TP04 TP05 TP06	TESTPOINTS-	2520B-1	USECO	2112-19-0005	6.000
U01	BAL MOD/DEMOD STATIC SENSITIVE #2	LM1496N	NAT	7000-07-9600	1.000
U02 U03 U25 U26	SPDT ANALOG SWITCH STATIC SENSITIVE	TL607CP	T-I	7000-06-0700	4.000
U04 U05 U06 U07	TRANSISTOR ARRAY STATIC SENSITIVE #2	LM3054N	NAT	7000-30-5400	4.000
U08 U10 U12 U13 U15 U24	DUAL OP AMP STATIC SENSITIVE #2	TL082CP	T-I	7000-00-8200	6.000
U09	TIMERSTATIC SENSITIVE	ICM7555IPA	INT	7000-75-5510	1.000
U11	DUAL J-K FLIP-FLOP STATIC SENSITIVE	MM74C76	NAT	8000-74-7611	1.000
U14	QUAD BILAT SWITCH STATIC SENSITIVE	CD4016AE	RCA	8000-40-1610	1.000
U16	IF AMP STATIC SENSITIVE #2	MC1350P	MOT	7000-13-5000	1.000
U17	DETECTOR/BUFFER STATIC SENSITIVE	MC1330A1P	MOT	7000-13-3000	1.000
U18 U22 U23	QUAD 2-IN NAND STAT.SENS.	MM74C00N	NAT	8000-74-0011	3.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	PART NO.	QTY
U19	IC,FM IF SYSTEM STATIC SENSITIVE	CA3189E	RCA	7000-31-8900	1.000
U20	DECADE COUNTED/DIV STATIC SENSITIVE	MC14017B	MOT	8001-40-1710	1.000
U21	PHASE LKD. LOOP STATIC SENSITIVE	CD4046AE	RCA	8000-40-4610	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG MFGR PART NO	MFGR	PART NUMBER	QTY
R191	RES, C, 1/8W, 1%, 806	RN55D-806	MILSP	4701-03-8060	1.000
R192	RES, C, 1/8W, 1%, 243	RN55D-243	MILSP	4701-03-2430	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	Part No.	QTY
C01 C02 C03 C04 C05 C06 C105 C112 C113 C115 C119 C12 C120 C20 C21 C23 C26 C28 C29 C30 C31 C32 C34 C35 C36 C37 C40 C41 C51 C54 C56 C65 C71 C87	CAP,MON,50V,.01UF	CW15C103K	C-L	1510-14-4103	34.000
C07 C42 C61	CAP,ELEC,16V,100UF	ECEB1CV101S	PNSNC	1510-25-8102	3.000
C08 C109 C15 C24 C38 C47 C50	CAP,ELEC,16V,470UF	ECEB1CV471S	PNSNC	1510-25-8471	7.000
C09 C10 C11 C13 C14 C16 C17 C18 C19 C22 C25 C27 C33 C39 C43 C44 C45 C48 C52 C69 C70 C72 C73 C74 C75 C78 C85 C89 C91 C92 C99	CAP,MON,100V,470PF	CW15A471M	C-L	1510-14-5471	31.000
C46 C49 C53 C76 C80 C82 C88 C90 C93 C94 C97 C98	CAP,MON,50V,6.8PF	C312C689J2G5CA	UNCAR	1510-11-8689	12.000
C59	CAP,MON,50V,.0047UF	CN30C472K	CRL	1510-11-8472	1.000
C68	CAP,COMP,500V,4.7PF	MC-4.7PF	Q-C	1510-40-1479	1.000
C77	CAP,TANT,35V,1UF	196D105X9035HA1	SPR	1510-25-3109	1.000
C79 C95	CAP,MICA,500V,50PF	DM15-500J	ARC	1510-50-0500	2.000
C81	CAP,POLY,160V,.47UF	171/.47/K/160/N	WSTLK	1510-63-8474	1.000
C83	CAP,DISC,1KV,.001UF	5GAD10	SPR	1510-10-1102	1.000
C84	CAP,DISC,1KV,.002UF	5GAD20	SPR	1510-10-1202	1.000
C96	CAP,MICA,500V,15 PF	DM15-150J	ARC	1510-50-0150	1.000
C100 C101 C102 C103 C104 C118 C57	CAP,MON,50V,100PF	RA50-101JA	MURGA	1510-11-8101	7.000
C106 C58 C67 C86	CAP,TANT,20V,10UF	196D106X9020JA1	SPR	1510-25-2100	4.000
C107 C111	CAP,DISC,.05UF	UK25-503	C-L	1510-14-1503	2.000
C110	CAP,COMP,500V,8.2PF	8.2PF 5%	Q-C	1510-40-0829	1.000
C114	CAP,DISC,.01UF	UK25-103	C-L	1510-14-1103	1.000
C116 C60 C62 C64	CAP,MON,50V,.22UF	8131-050-151-224M	ETP	1510-14-6224	4.000
C117	CAP,MICA,500V,.001UF	DM15-102J	ARC	1510-50-0102	1.000
CR01 CR02	DIODE,TUNING,UHF/VHF STATIC SENSITIVE ‡2	ZC802	MSI	4803-02-0023	2.000
CR03 CR05 CR06 CR08 CR11 CR16 CR18	DIODE,PIN STATIC SENSITIVE ‡2	MPN3401	MOT	4805-02-0006	7.000
CR04 CR07 CR20 CR21 CR22 CR23 CR28 CR29 CR30	DIODE,SIGNAL STATIC SENSITIVE ‡2	1N914	G-E	4807-01-0914	9.000
CR09 CR12 CR13 CR14 CR15 CR19	DIODE, SIGNAL STATIC SENSITIVE ‡2	HSCH1001	H-P	4807-01-6263	6.000

COMTEST PARTS LIST	RF SYNTH BD,A3,3100	1110-70-0066 PAGE: 1	D REV

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	Part No.	QTY
L7, Factory Selected Value	CHOKE				1.000
CR10 CR17	DIODE, VARACTOR STATIC SENSITIVE #2	1N5767	HP	4803-02-0018	2.000
CR24, CR25 CR26 CR27	DIODE, QUAD SET STATIC SENSITIVE	5082-2805	H-P	4899-02-0002	4.000
CR31 CR32	DIODE,ZENER,8.2V STATIC SENSITIVE	IN5237B	T-I	4801-01-5237	2.000
J01 J02	CONN,RF,STR,JACK	700209	CBLWV	2110-08-0006	2.000
L01 L02 L03 L04 L05 L06 L08 L11 L16 L17	CHOKE	VK20010/3B	FRXC	1810-09-0001	10.000
L09	FERRITE CHOKE,5 TURN FROM: 1813-00-0007	LA006-005	W-I	1210-30-0002	1.000
L10 L12 L18 L20	CHOKE,MOLDED,100 UH	1025-68	DEL	1810-10-0101	4.000
L13	INDUCTOR,AIR,2TURN PER DWG	1555-0010	SSI	1815-00-0067	1.000
L14 L15	COIL,2T,NO.22,.12 ID	1815-00-0038	W-I	1815-00-0038	2.000
L19	CHOKE,MOLDED,39 UH	1025-58	DEL	1810-10-0390	1.000
Q01 Q08	TRANSISTOR STATIC SENSITIVE #2	PN4356-5	NAT	4901-04-3560	2.000
Q02 Q03	TRANSISTOR STATIC SENSITIVE #2	A400	APX	4902-00-4000	2.000
Q04 Q05 Q06 Q07	TRANSISTOR STATIC SENSITIVE #2	PN4275	NAT	4902-04-2750	4.000
Q09	TRANSISTOR STATIC SENSITIVE #2	PN2222	NAT	4901-02-2220	1.000
R01 R04	RES,C,1/4W,5%,82	CF1/4-82	ASE	4700-15-8209	2.000
R02	RES,C,1/4W,5%,820	CF1/4-820	ASE	4700-15-8200	1.000
R03 R43 R51 R57	RES,C,1/4W,5%,1.5K	CF1/4-1.5K	ASE	4700-15-1501	4.000
R05	RES,1/4W 5%,39	CF-1/4-39	ASE	4700-15-3909	1.000
R06 R10	RES,C,1/4W,5%,47	CF1/4-47	ASE	4700-15-4709	2.000
R07 R174 R18	RES,C,1/4W,5%,100	CF1/4-100	ASE	4700-15-1000	3.000
R08	RES,C,1/4W,5%,390	CF1/4-390	ASE	4700-15-3900	1.000
R09 R113 R14	RES,C,1/4W,5%,39K	CF1/4-39K	ASE	4700-15-3902	3.000
R11 R12 R121 R127 R129 R13 R132 R136 R97	RES,C,1/4W,5%,4.7K	CF1/4-4.7K	ASE	4700-15-4701	9.000
R15 R175 R84	RES,C,1/4W,5%,330	CF1/4-330	ASE	4700-15-3300	3.000
R19 R49	RES,C,1/4W,5%,220	CF1/4-220	ASE	4700-15-2200	2.000
R20 R56	RES,MF,1/8W,1%,48.7	RN55D-48.7	MILSP	4701-03-4879	2.000
R21 Factory Selected Value	RES,MF,1/8W,1%,19.6K	RN55D-19.6K	MILSP	4701-03-1962	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	Part No.	QTY
R22	RES,C,1/4W,5%,36	4700-15-3609	W-I	4700-15-3609	1.000
R23 R27 R32 R38 R39 R65	RES,C,1/4W,5%,2.2K	CF1/4-2.2K	ASE	4700-15-2201	6.000
R25	RES,MF,1/8W,1%,27.4K	RN55D-27.4K	MILSP	4701-03-2742	1.000
R26 R28	RES,C,1/8W,5%,12	CF1/8-12	ASE	4700-05-1209	2.000
R29	RES,C,1/8W,5%,100 RC101-110	CF1/8-100	ASE	4700-05-1000	1.000
R37 R40	RES,C,1/8W,5%,2.2K	CF1/8-2.2K	ASE	4700-05-2201	2.000
R41 R55	RES,MF,1/8W,1%,84.5	RN55D-84.5	MILSP	4701-03-8459	2.000
R42	RES,MF,1/8W,1%,22.1	RN55D-22.1	MILSP	4701-03-2219	1.000
R44 R45	RES,C,1/4W,5%,10	CF1/4-10	ASE	4700-15-1009	2.000
R50	RES,C,1/4W,5%,15K	CF1/4-15K	ASE	4700-15-1502	1.000
R52 R69 R94	RES,C,1/4W,5%,3.3K	CF1/4-3.3K	ASE	4700-15-3301	3.000
R53	RES,C,1/4W,5%,12K	CF1/4-12K	ASE	4700-15-1202	1.000
R60	RES,C,1/4W,5%,120	CF1/4-120	ASE	4700-15-1200	1.000
R61	RES,C,1/4W,5%,820K	CF1/4-820K	ASE	4700-15-8203	1.000
R62	RES,C,1/4W,5%,30K	CF1/4-30K	ASE	4700-15-3002	1.000
R63 R93	RES,C,1/4W,5%,51	CF1/451	ASE	4700-15-5109	2.000
R67	RES,MF,1/8W,1%,20K	RN55D-20K	MILSP	4701-03-2002	1.000
R71	RES,MF,1/8W,1%,332K	RN55D-332K	MILSP	4701-03-3323	1.000
R72	RES,MF,1/8W,1%,76.8K	RN55D-76.8K	MILSP	4701-03-7682	1.000
R73	RES,MF,1/8W,1%,432K	RN55D-432K	MILSP	4701-03-4323	1.000
R74	RES,MF,1/8W,1%,48.7K	RN55D-48.7K	MILSP	4701-03-4872	1.000
R75	RES,MF,1/8W,1%,806K	RN55D-806K	MILSP	4701-03-8063	1.000
R76	RES,MF,1/8W,1%,34.0K	RN55D-34.0K	MILSP	4701-03-3402	1.000
R78	RES,MF,1/8W,1%,26.7K	RN55D-26.7K	MILSP	4701-03-2672	1.000
R80	RES,MF,1/8W,1%,110K	RN55D-110K	MILSP	4701-03-1103	1.000
R81	RES,MF,1/8W,1%,26.1K	RN55D-26.1K	MILSP	4701-03-2612	1.000
R100 R101 R34 R36	RES,C,1/4W,5%,2.7K	CF1/4-2.7K	ASE	4700-15-2701	4.000
R102 R68	RES,C,1/4W,5%,9.1K	CF1/4-9.1K	ASE	4700-15-9101	2.000
R103 R115 R66	RES,MF,1/8W,1%,10K	RN55D-10K	MILSP	4701-03-1002	3.000
R104	RES,MF,1/8W,1%,45.3K	RN55D-45.3K	MILSP	4701-03-4532	1.000
R105	RES,C,1/4W,5%,2.4M	CF1/4-2.4M	ASE	4700-15-2404	1.000
R106 R91	POT,10K	3386W-1-103	BOU	4610-02-0103	2.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	Part No.	QTY
R107 R149 R150 R176 R92	RES,C,1/4W,5%,100K	CF1/4-100K	ASE	4700-15-1003	5.000
R108 R123 R124 R70 R86 R87 R88 R90 R95 R96	RES,C,1/4W,5%,270	CF1/4-270	ASE	4700-15-2700	10.000
R109 R169 R24 R79	RES,C,1/4W,5%,1K	CF1/4-1K	ASE	4700-15-1001	4.000
R110	RES,C,1/4W,5%,18K	CF1/4-18K	ASE	4700-15-1802	1.000
R111	RES,C,1/4W,5%,1.1M	RCF 1X1M-QB	CII	4700-15-1104	1.000
R112	RES,C,1/4W,5%,27K	CF1/4-27K	ASE	4700-15-2702	1.000
R114 R116 R117 R118 R119	RES,MF,1/8W,1%,82.5K	RN55D-82.5K	MILSP	4701-03-8252	5.000
R120	RES,C,1/4W,5%,47K	CF1/4-47K	ASE	4700-15-4702	1.000
R122 R125 R134 R135	RES,C,1/4W,5%,680	CF1/4-680	ASE	4700-15-6800	4.000
R126 R130 R131 R137 R140 R54	RES,C,1/4W,5%,1.8K	CF1/4-1.8K	ASE	4700-15-1801	6.000
R128 R139 R16 R98	RES,C,1/4W,5%,68	CF1/4-68	ASE	4700-15-6809	4.000
R133	RES,C,1/4W,5%,62	CF1/4-62	ASE	4700-15-6209	1.000
R138 R35 R83 R85	RES,C,1/4W,5%,560	CF1/4-560	ASE	4700-15-5600	4.000
R141 R142 R143 R144 R145 R99	RES,C,1/4W,5%,200	CF1/4-200	ASE	4700-15-2000	6.000
R146	RES,C,1/4W,5%,2.2M	CF1/4-2.2M	ASE	4700-15-2204	1.000
R147 R64	RES,C,1/4W,5%,6.8K	CF1/4-6.8K	ASE	4700-15-6801	2.000
R148	RES,C,1/4W,5%,1M	CF1/4-1M	ASE	4700-15-1004	1.000
R151	RES,C,1/4W,5%,2K	CF1/4-2K	ASE	4700-15-2001	1.000
R152 R153 R154 R30 R31 R33 R46 R47 R58	RES,C,1/4W,5%,10K	CF1/4-10K	ASE	4700-15-1002	9.000
R155	RES,MF,1/8W,1%,3.48K	RN55D-3.48K	MILSP	4701-03-3481	1.000
R156	RES,MF,1/8W,1%,130K	RN55D-130K	MILSP	4701-03-1303	1.000
R157	RES,MF,1/8W,1%,6.34K	RN55-6.34K	MILSP	4701-03-6341	1.000
R158	RES,MF,1/8W,1%,14.3K	RN55D-14.3K	MILSP	4701-03-1432	1.000
R159	RES,MF,1/8W,1%,30.9K	RN55D-30.9K	MILSP	4701-03-3092	1.000
R160	RES,MF,1/8W,1%,63.4K	RN55D-63.4K	MILSP	4701-03-6342	1.000
R161	RES,MF,1/8W,1%,2.26K	RN55D-2.26K	MILSP	4701-03-2261	1.000
R162	RES,MF,1/8W,1%,1.82K	RN55D-1.82K	MILSP	4701-03-1821	1.000
R163	RES,C,1/4W,5%,8.2K	CF1/4-8.2K	ASE	4700-15-8201	1.000
R164	POT,50K	3386W-1-503	BOU	4610-02-0503	1.000
R165	RES,MF,1/8W,1%,523	RN55D-523	MILSP	4701-03-5230	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	Part No.	QTY
R166	RES,C,1/4W,5%,33K	CF1/4-33K	ASE	4700-15-3302	1.000
R167 R48 R82	RES,C,1/4W,5%,470	CF1/4-470	ASE	4700-15-4700	3.000
R168	RES,C,1/4W,5%,1.2K	CF1/4-1.2K	ASE	4700-15-1201	1.000
R171	RES,MF,1/8W,1%,17.4K	RN55D-17.4K	MILSP	4701-03-1742	1.000
R172 R173	RES,C,1/4W,5%,510	CF1/4-510	ASE	4700-15-5100	2.000
T01	XFMR, BIFILAR	1501-0001	SSI	1210-43-0011	1.000
TP01 TP02	TESTPOINTS-	2520B-1	USECO	2112-19-0005	2.000
U06 U14	SPDT ANALOG SWITCH STATIC SENSITIVE	TL607CP	T-I	7000-06-0700	2.000
U07 U13 U15	OP AMP STATIC SENSITIVE #2	LF351N	NAT	7000-00-8100	3.000
U08	QUAD NOR, ECL STATIC SENSITIVE	100102PCQR	FCD	8010-01-0200	1.000
U09 U10	FLIP-FLOP,ECL STATIC SENSITIVE	F11C70	FCD	8000-11-7000	2.000
U11	QUAD 2-IN NOR,MOT STATIC SENSITIVE	MC10102P-MOT	MOT	8001-01-0201	1.000
U12 U23	DUAL OP AMP STATIC SENSITIVE #2	TL082CP	T-I	7000-00-8200	2.000
U16	AM/FM MIG PLL SYNTH STATIC SENSITIVE	DS8906	NAT	8000-89-0600	1.000
U17	DUAL FLIP-FLOP,ECL STATIC SENSITIVE	10231PCQR	FCD	8001-02-3100	1.000
U18	QUAD 2-IN NAND STAT.SENS.	MM74C00N	NAT	8000-74-0011	1.000
U19	MONO/ASTABLE MLTVBTR STATIC SENSITIVE	CD4047BC	NAT	8000-40-4710	1.000
U20	IC,IL004-001 STATIC SENSITIVE #2	LM339N	NAT	7000-03-3900	1.000
U21 U24	QUAD SPST SWITCH STATIC SENSITIVE	DG308	SCX	7000-03-0800	2.000
U22	HEX INVERTER STATIC SENSITIVE	MM74C04N	NAT	8000-74-0412	1.000
U25	VOLT REG,-12 STATIC SENSITIVE #2	LM79L12ACZ	NAT	7000-79-1210	1.000
U26	VOLTAGE REG,12 STATIC SENSITIVE #2	LM78L12ACZ	NAT	7000-78-1220	1.000
U1, U2, U3, U4, U5	See Page 6				

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG MFGR PART NO	MFGR	PART NUMBER	QTY
U1, U2, U3, U4, U5	WIDE BAND AMP	MWA320	MOT	7000-03-2000	5.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	Part No.	QTY
AT04	ATTEN,150W,30DB	CR1111	ACRIN	3010-52-0015	1.000
C01 C02 C03 C04 C05 C06 C07 C08 C100 C101 C105 C106 C107 C11 C110 C111 C113 C114 C116 C120 C121 C122 C123 C124 C125 C126 C129 C132 C133 C134 C135 C138 C140 C142 C143 C151 C152 C156 C157 C158 C17 C27 C29 C30 C31 C32 C33 C35 C36 C42 C45 C46 C47 C48 C49 C51 C53 C54 C55 C56 C58 C63 C65 C66 C68 C69 C70 C71 C74 C75 C76 C78 C79 C80 C82 C83 C84 C85 C86 C89 C96 C97 C98 C99	CAP,MON,50V,.01UF	CW15C103K	C-L	1510-14-4103	84.000
C09 C10 C139 C21 C57 C59 C60 C62	CAP,TANT,20V,10UF	196D106X9020JA1	SPR	1510-25-2100	8.000
C12	CAP,MON,50V,100PF	RA50-101JA	MURGA	1510-11-8101	1.000
C14	CAP,MON,50V,56PF	RA50-560JA	MURGA	1510-11-8560	1.000
C15 C16 C23 C28	CAP,MON,50V,.22UF	8131-050-151-224M	ETP	1510-14-6224	4.000
C18	CAP,MICA,500V,82PF	CM05ED820J03	SPR	1510-50-0820	1.000
C19 C24	CAP,MICA,500V,75PF	CM05ED750J03	C-D	1510-50-0750	2.000
C20	CAP,MICA,500V,12PF	CM05CD120J03	SPR	1510-50-8120	1.000
C25	CAP,COMP,500V,2PF	QC-2.0PF	Q-C	1510-40-0020	1.000
C26	CAP,MICA,500V,.001UF	DM15-102J	ARC	1510-50-0102	1.000
C34	CAP,MICA,500V,330PF	DM15-331J	ARC	1510-50-0331	1.000
C38	CAP,MON,50V,68PF	RA50-680JA	MURGA	1510-11-8680	1.000
C39 C41	CAP,MON,50V,180PF	RA50-181JA	MURGA	1510-11-8181	2.000
C40	CAP,MON,50V,.0015UF	SR205A152JAA	AER	1510-13-0152	1.000
C43	CAP,COMP,500V,3.9PF	QC-3.9PF	Q-C	1510-40-0399	1.000
C61 C81	CAP,FILM,.0056 UF	160-.0056K400C	PLSSY	1510-61-7562	2.000
C64	CAP,MON,50V,15PF	1006-0151	SSI	1510-11-8150	1.000
C67 C72 C73	CAP,TANT,35V,1UF	196D105X9035HA1	SPR	1510-25-3109	3.000
C77	CAP,DISC,.01UF	UK25-103	C-L	1510-14-1103	1.000
C91	CAP,MON,50V,27PF	RA50-270JA	MURGA	1510-11-8270	1.000
C92	CAP,MON,50V,6.8PF	C312C689J2G5CA	UNCAR	1510-11-8689	1.000
C94	CAP,MON,50V,10PF	RA50-100DA	MURGA	1510-11-8100	1.000
C102 C87	CAP,MON,50V,120PF	RA50-121JA	MURGA	1510-11-8121	2.000
C88, C103 - See Page 8					

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	Part No.	QTY
C104 C37 C44 C90 C93 C95	CAP,VAR,18PF	GKU18000	SPR	1510-71-4180	6.000
C108 C109 C112 C115 C130 C136 C137 C141 C144 C148 C149 C154 C155	CAP,CHIP,.1 UF	51C1209-B104Z	CFI	1510-00-3104	13.000
C117 C118 C119 C127 C128	CAP,MON,100V,470PF	CW15A471M	C-L	1510-14-5471	5.000
C131 C52	CAP,ELEC,16V,100UF	20YH100	MOUS	1510-27-6101	2.000
C145	CAP,FILM,.15 UF	225P15491XD3	SPR	1510-62-1154	1.000
C146	CAP,MON,50V,2.2PF	C312C229D2G5CA	UNCAR	1510-11-8229	1.000
C153	CAP,MICA,500V,10PF	CM05CD100D03	SPR	1510-50-8100	1.000
C159 C22	CAP,MON,50V,1UF	3420-050-E105M	AER	1510-11-3105	2.000
C160	CAP,CHIP,5.6 PF	C0805C569D5GAH	UNCAR	1510-01-4569	1.000
C161	CAP,COMP,500V,1PF	GC-1PF	G-C	1510-40-0010	1.000
C162	CAP,COMP,500V,.39PF	MC-.39PF	G-C	1510-40-1398	1.000
CR01	DIODE,TUNING,UHF/VHF STATIC SENSITIVE ‡2	ZC802	MSI	4803-02-0023	1.000
CR02 CR12 CR13 CR14 CR21 CR22 CR23 CR24 CR25 CR26 CR29 CR30 CR39, CR40	DIODE,SIGNAL STATIC SENSITIVE ‡2	1N914	G-E	4807-01-0914	14.000
CR3/4	DIODE,MATCHED PAIR STATIC SENSITIVE ‡2	5082-2804	H-P	4898-00-0001	1.000
CR05 CR06 CR07 CR15 CR16 CR17 CR18 CR19 CR20 CR37 CR38	DIODE, VARACTOR STATIC SENSITIVE ‡2	1N5767	HP	4803-02-0018	11.000
CR09 CR11	DIODE,TUNING,UHF/VHF STATIC SENSITIVE ‡2	ZC804	MSI	4803-02-0024	2.000
CR27 CR28	DIODE,SCHOTTKY STATIC SENSITIVE	5082-2811	H-P	4809-02-0007	2.000
CR31 CR32 CR33 CR34	DIODE, SIGNAL STATIC SENSITIVE ‡2	1N4444	UNIT	4807-01-4444	4.000
CR35 CR36 CR41	DIODE,ZENER,3.9V STATIC SENSITIVE ‡2	1N5228B	NEC	4801-01-5228	3.000
J01 J02 J03	CONN,RF,STR,JACK	700209	CBLWV	2110-08-0006	3.000
K01	RELAY,RF,N.C.	234-4-1	WBSH	4510-00-0017	1.000
K02	RELAY,RF,N.O.	234-3-1	WBSH	4510-00-0016	1.000
L01 L02 L03 L10	CHOKE	VK20010/3B	FRXC	1810-09-0001	4.000
L04	CHOKE,MOLDED,5.6MILH RF SHIELDED	1641-565	DEL	1810-10-0564	1.000
L05 L07	CHOKE,SHIELD,1500UH	17/154	GWNDA	1810-10-1501	2.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	Part No.	QTY
L06	COIL,VAR,2T FROM:1813-00-0046	1210-32-0028	W-I	1210-32-0028	1.000
L08	CHOKE,MOLDED,0.12 UH	1025-96	DEL	1810-10-0128	1.000
L09	CHOKE,MOLDED,.68UH	10/680	GWNDA	1810-10-0688	1.000
L11	CHOKE,MOLDED,.15UH	10/150	GWNDA	1810-10-0158	1.000
L12 L17 L18 L20 L25 L26 L27 L29 L30	CHOKE,MOLDED,100 UH	1025-68	DEL	1810-10-0101	9.000
L13 L16	CHOKE,.039UH	551-5169-03	CAMB	1810-14-0398	2.000
L14 L15	COIL,1UH,18 TURN FROM:1813-00-0079	1210-30-0012	W-I	1210-30-0012	2.000
L19 L24	CHOKE,MOLDED,6.8 UH	1025-40	DEL	1810-10-0689	2.000
L21 L22 L23	FERRITE CHOKE,5 TURN FROM: 1813-00-0007	LA006-005	W-I	1210-30-0002	3.000
M01	MIXER,DBL.BAL.	SBL-1-DBL	MIN-C	3010-54-0004	1.000
M02	MIXER,DBL.BAL.	TFM-2-DBL	MIN-C	3010-54-0005	1.000
Q01 Q10 Q12 Q13 Q14	TRANSISTOR STATIC SENSITIVE ‡2	PN4121-18	NAT	4901-04-1210	5.000
Q02 Q05 Q06 Q08 Q09 Q11	TRANS QA035-630 STATIC SENSITIVE ‡2	2N3563	FCD	4901-03-5630	6.000
Q03 Q04	TRANSISTOR STATIC SENSITIVE ‡2	PN4356-5	NAT	4901-04-3560	2.000
Q07	TRANSISTOR STATIC SENSITIVE ‡2	A400	APX	4902-00-4000	1.000
Q15 Q19	TRANSISTOR STATIC SENSITIVE ‡2	PN2222	NAT	4901-02-2220	2.000
Q16 Q17 Q18	TRANSISTOR STATIC SENSITIVE ‡2	2N4403	NAT	4901-04-4030	3.000
R01 R02 R91	RES,C,1/4W,5%,2.2M	CF1/4-2.2M	ASE	4700-15-2204	3.000
R03 R131 R138 R142 R17 R173 R35 R55 R86	RES,C,1/4W,5%,470	CF1/4-470	ASE	4700-15-4700	9.000
R04 R12 R13 R149 R152 R33 R36 R63 R64 R65 R72 R81 R82 R89 R90 R92 R93	RES,C,1/4W,5%,10K	CF1/4-10K	ASE	4700-15-1002	17.000
R05 R100 R104 R115 R21 R32	RES,C,1/4W,5%,10	CF1/4-10	ASE	4700-15-1009	6.000
R06 R07 R08 R15 R18	RES,C,1/4W,5%,100K	CF1/4-100K	ASE	4700-15-1003	5.000
R09	POT,50K	3386W-1-503	BOU	4610-02-0503	1.000
R10 R58 R80 R83	RES,C,1/4W,5%,15K	CF1/4-15K	ASE	4700-15-1502	4.000
R11	RES,MF,1/8W,1%,255K	RN55D-255K	MILSP	4701-03-2553	1.000
R14 R19	RES,C,1/4W,5%,300K	CF1/4-300K	ASE	4700-15-3003	2.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	Part No.	QTY
R16 R45	RES,C,1/4W,5%,1.5K	CF1/4-1.5K	ASE	4700-15-1501	2.000
R20	RES,C,1/4W,5%,270	CF1/4-270	ASE	4700-15-2700	1.000
R22	RES,C,1/4W,5%,620	CF1/4-620	ASE	4700-15-6200	1.000
R23	RES,C,1/4W,5%,200	CF1/4-200	ASE	4700-15-2000	1.000
R24 R62	RES,C,1/4W,5%,16K	CF1/4-16K	ASE	4700-15-1602	2.000
R25	POT,10K	3386W-1-103	BOU	4610-02-0103	1.000
R27	POT,100K	3386W-1-104	BOU	4610-02-0104	1.000
R28	RES,C,1/4W,5%,15M	CB1565	A-B	4700-15-1505	1.000
R29	RES,C,1/4W,5%,10M	CB1065	A-B	4700-15-1005	1.000
R31 R50 R85	RES,C,1/4W,5%,100	CF1/4-100	ASE	4700-15-1000	3.000
R34	RES,C,1/4W,5%,5.6K	CF1/4-5.6K	ASE	4700-15-5601	1.000
R38	RES,1/4W 5%,39	CF-1/4-39	ASE	4700-15-3909	1.000
R40 R94 R96	RES,C,1/4W,5%,1.1K	CF1/4-1.1K	ASE	4700-15-1101	3.000
R43	RES,C,1/4W,5%,24	RCF-24-QB	CII	4700-15-2409	1.000
R47	RES,C,1/4W,5%,82	CF1/4-82	ASE	4700-15-8209	1.000
R48	RES,C,1/4W,5%,820	CF1/4-820	ASE	4700-15-8200	1.000
R49	RES,C,1/4W,5%,1.8K	CF1/4-1.8K	ASE	4700-15-1801	1.000
R52	RES,C,1/4W,5%,47	CF1/4-47	ASE	4700-15-4709	1.000
R53 R54 R60 R61	RES,C,1/4W,5%,62K	CF1/4-62K	ASE	4700-15-6202	4.000
R57	RES,C,1/4W,5%,27K	CF1/4-27K	ASE	4700-15-2702	1.000
R67	RES,C,1/4W,5%,4.7M	CB4755	A-B	4700-15-4704	1.000
R68	RES,C,1/4W,5%,1M	CF1/4-1M	ASE	4700-15-1004	1.000
R70	RES,C,1/4W,5%,68	CF1/4-68	ASE	4700-15-6809	1.000
R75 R77	RES,C,1/4W,5%,75	CR1/4-75	ASE	4700-15-7509	2.000
R76	RES,C,1/4W,5%,110	CF1/4-110	ASE	4700-15-1100	1.000
R78	RES,C,1/4W,5%,39K	CF1/4-39K	ASE	4700-15-3902	1.000
R84	RES,C,1/4W,5%,3K	CF1/4-3K	ASE	4700-15-3001	1.000
R87	RES,C,1/4W,5%,3.9	CF1/4-3.9	ASE	4700-15-3908	1.000
R98	RES,C,1/4W,5%,36	4700-15-3609	W-I	4700-15-3609	1.000
R101 R103 R176 R183 R186	RES,CH,1/8W,1%,221	BCK2210FB	A-B	4711-03-2210	5.000
R102	RES,MF,1/8W,1%,23.7	RN55D-23.7	MILSP	4701-03-2379	1.000
R105 R107 R118 R126	RES,C,1/4W,5%,22	CF1/4-22	ASE	4700-15-2209	4.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	Part No.	QTY
R106 R155	RES,C,1/4W,5%,560	CF1/4-560	ASE	4700-15-5600	2.000
R108	RES,C,1/4W,5%,910	CF1/4-910	ASE	4700-15-9100	1.000
R109 R37 R39	RES,C,1/4W,5%,150	CF1/4-150	ASE	4700-15-1500	3.000
R110 R123 R99	RES,C,1/4W,5%,360	CF1/4-360	ASE	4700-15-3600	3.000
R111 R174	RES,C,1/4W,5%,430	CF1/4-430	ASE	4700-15-4300	2.000
R112 R120	RES,C,1/4W,5%,180	CF1/4-180	ASE	4700-15-1800	2.000
R113	POT,100	3386W-1-101	BOU	4610-02-0101	1.000
R114	RES,C,1/4W,5%,2.7	CF1/4-2.7	ASE	4700-15-2708	1.000
R116	RES,C,1/4W,5%,2.2K	CF1/4-2.2K	ASE	4700-15-2201	1.000
R117	RES,C,1/4W,5%,160	CF1/4-160	ASE	4700-15-1600	1.000
R119 R51 R74	RES,C,1/4W,5%,390	CF1/4-390	ASE	4700-15-3900	3.000
R121 R135	RES,C,1/4W,5%,51	CF1/451	ASE	4700-15-5109	2.000
R122 R179 R26 R41 R95 R97	RES,C,1/4W,5%,1K	CF1/4-1K	ASE	4700-15-1001	6.000
R124 R30	RES,C,1/4W,5%,2K	CF1/4-2K	ASE	4700-15-2001	2.000
R125	RES,C,1/4W,5%,91	CF1/4-91	ASE	4700-15-9109	1.000
R127 R139	RES,MF,1/8W,1%,287	RN55D-287	MILSP	4701-03-2870	2.000
R128 R140	RES,MF,1/8W,1%,84.5	RN55D-84.5	MILSP	4701-03-8459	2.000
R129 R141	RES,MF,1/8W,1%,22.1	RN55D-22.1	MILSP	4701-03-2219	2.000
R130	RES,C,1/4W,5%,12K	CF1/4-12K	ASE	4700-15-1202	1.000
R132 R151	RES,C,1/4W,5%,150K	CF1/4-150K	ASE	4700-15-1503	2.000
R133	RES,C,1/4W,5%,8.2K	CF1/4-8.2K	ASE	4700-15-8201	1.000
R134	RES,C,1/4W,5%,4.3K	CF1/4-4.3K	ASE	4700-15-4301	1.000
R136	RES,CH,1/8W,5%,39	ERJ-8GCJ390D	PNSNC	4711-05-3909	1.000
R137 R172	RES,CH,1/8W,5%,150	ERJ-8GCJ151D	PNSNC	4711-05-1500	2.000
R143	RES,CHIP,2W,4K	2S12CPX402K	SOART	4711-45-4001	1.000
R144	RES,CH,1/8W,1%,247	BCK2470FB	A-B	4711-03-2470	1.000
R145 R73	RES,C,1/4W,5%,6.8K	CF1/4-6.8K	ASE	4700-15-6801	2.000
R146	RES,MF,1/8W,1%,33.2K	RN55D-33.2K	MILSP	4701-03-3322	1.000
R147	RES,MF,1/8W,1%,1.18K	RN55D-1.18K	MILSP	4701-03-1181	1.000
R148 R42 R44	RES,C,1/4W,5%,220	CF1/4-220	ASE	4700-15-2200	3.000
R150	RES,C,1/4W,5%,56K	CF1/4-56K	ASE	4700-15-5602	1.000
R153 R160 R56 R88	RES,C,1/4W,5%,4.7K	CF1/4-4.7K	ASE	4700-15-4701	4.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	Part No.	QTY
R154	POT,2K	3386W-1-202	BOU	4610-02-0202	1.000
R156	RESISTOR,VARIABLE1K	3386W-1-102	BOU	4610-02-0102	1.000
R157	POT,1M	3386W-1-105	BOU	4610-02-0105	1.000
R158	RES,C,1/4W,5%,510K	CF1/4-510K	ASE	4700-15-5103	1.000
R159	RES,MF,1/8W,1%,475K	RN55D-475K	MILSP	4701-03-4753	1.000
R161	RES,C,1/4W,5%,22K	CF1/422K	ASE	4700-15-2202	1.000
R162	RES,C,1/8W,5%,22	CF1/8-22	ASE	4700-05-2209	1.000
R163 R164	RES,MF,1/8W,1%,14.7K	RN55D-14.7K	MILSP	4701-03-1472	2.000
R165 R166 R167 R168	RES,MF,1/8W,.1%,200K	RN55C2003B	MILSP	4701-02-2003	4.000
R169	RES,C,1/4W,5%,180K	CF1/4-180K	ASE	4700-15-1803	1.000
R170 R171 R59 R66 R69 R79	RES,C,1/4W,5%,20K	CF1/4-20K	ASE	4700-15-2002	6.000
R175 R71	RES,C,1/4W,5%,330	CF1/4-330	ASE	4700-15-3300	2.000
R177 R178 R182 R184 R185 R188	CHIP RES. 61.6	RSW/CC/61.6/1/T	TRX	4711-03-6169	6.000
R180	POT,5K	3386W-1-502	BOU	4610-02-0502	1.000
R181	RES,CH,1/8W,5%,110	ERJ-8GCJ111D	PNSNC	4711-05-1100	1.000
R187 R46	RES,C,1/4W,5%,3.3K	CF1/4-3.3K	ASE	4700-15-3301	2.000
T01	XFMR, BIFILAR	1501-0001	SSI	1210-43-0011	1.000
U01	QUAD EXCL. OR GATE STATIC SENSITIVE	CD4030BE	RCA	8000-40-3010	1.000
U02	VOLT REG,+5V STATIC SENSITIVE #2	MA78L05AWC	FCD	7000-78-0501	1.000
U03	VCO, 200 MHZ STATIC SENSITIVE #2	MC1648N	MOT	7000-16-4800	1.000
U04 U07 U08 U15 U16 U20 U21 U26	DUAL OP AMP STATIC SENSITIVE #2	TL082CP	T-I	7000-00-8200	8.000
U05	HI-SPEED PRESCALER STATIC SENSITIVE	CA3179	RCA	8001-20-7100	1.000
U06	IF AMP STATIC SENSITIVE #2	MC1350P	MOT	7000-13-5000	1.000
U09	VOLTAGE REG,12 STATIC SENSITIVE #2	LM78L12ACZ	NAT	7000-78-1220	1.000
U10	OP AMP STATIC SENSITIVE #2	LF351N	NAT	7000-00-8100	1.000
U11	AM/FM DIG PLL SYNTH STATIC SENSITIVE	IS8906	NAT	8000-89-0600	1.000
U12	IC,IL004-001 STATIC SENSITIVE #2	LM339N	NAT	7000-03-3900	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	Part No.	QTY
U13	QUAD 2-IN NAND STAT.SENS.	MM74C00N	NAT	8000-74-0011	1.000
U14	MONO/ASTABLE MLTVBTR STATIC SENSITIVE	CD4047BC	NAT	8000-40-4710	1.000
U22	TIMER STATIC SENSITIVE ¥2	NE55V	SIG	7000-05-5500	1.000
U27	QUAD BILAT SWITCH STATIC SENSITIVE	CD4016AE	RCA	8000-40-1610	1.000
U17, U18, U19, U23, U24, U25 - See Page 8					

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG MFGR PART NO	MFGR	PART NUMBER	QTY
C88, C103	CAP, MON, 50V, 22PF	RA50-220JA	MURGA	1510-11-8220	2.000
U17, U18, U19, U23, U24, U25	WIDE BAND AMP	MWA330	MOT	7000-03-3000	6.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	Part No.	QTY
C01 C05 C20	CAP,ELEC,25V,100UF	TE1211	SPR	1510-20-4101	3.000
C02 C03 C06	CAP,MON,50V,.01UF	CW15C103K	C-L	1510-14-4103	3.000
C04	CAP,ELEC,16V,100UF	ECEBICV101S	PNSNC	1510-25-8102	1.000
C07 C08 C09 C10 C13 C22 C30 C31 C33	CAP,MON,50V,.01UF	CN30C103K	CRL	1510-11-8103	9.000
C11	CAP,TANT,35V,1UF	196D105X9035HA1	SPR	1510-25-3109	1.000
C12	CAP,MICA,500V,820PF	DM15-821J	ARC	1510-50-0821	1.000
C14	CAP,MICA,500V,100PF	DM15-101J	C-D	1510-50-0101	1.000
C15 C16 C17 C18 C21	CAP,TANT,20V,10UF	196D106X9020JA1	SPR	1510-25-2100	5.000
C19 C24 C29	CAP,MON,50V,.22UF	8131-050-151-224M	ETP	1510-14-6224	3.000
C23 C25 C27 C28	CAP,DISC,.05UF	UK25-503	C-L	1510-14-1503	4.000
C26	CAP,TANT,35V,.10UF	PDT-.1/35K	NEMCO	1510-25-3108	1.000
C32	CAP,MON,50V,.0068UF	CN30C682K	CRL	1510-11-8682	1.000
C34	CAP,MON,50V,27PF	RA50-270JA	MURGA	1510-11-8270	1.000
C40	CAP,DISC,1KV,68PF	68U2J680J	MDC	1510-10-3680	1.000
CR01 CR02 CR04 CR05 CR06 CR07 CR08 CR09 CR10 CR11	DIODE,SIGNAL STATIC SENSITIVE #2	1N914	G-E	4807-01-0914	10.000
L01 L02 L03	CHOKE	VK20010/3B	FRXC	1810-09-0001	3.000
Q01	TRANSISTOR STATIC SENSITIVE #2	PN4275	NAT	4902-04-2750	1.000
Q02	TRAN,2N4091 STATIC SENSITIVE #2	2N4091	NAT	4901-04-0911	1.000
Q03	TRANSISTOR STATIC SENSITIVE #2	PN2222	NAT	4901-02-2220	1.000
R01 R02 R13 R14 R15 R16 R17	RES,C,1/4W,5%,22K	CF1/422K	ASE	4700-15-2202	7.000
R03	RES,C,1/4W,5%,5.1K	CF1/4-5.1K	ASE	4700-15-5101	1.000
R04	POT,10K	3386W-1-103	BOU	4610-02-0103	1.000
R05 R97	RES,C,1/4W,5%,2.2K	CF1/4-2.2K	ASE	4700-15-2201	2.000
R06 R66 R69 R70 R73 R82	RES,C,1/4W,5%,10K	CF1/4-10K	ASE	4700-15-1002	6.000
R07	RES,MF,1/8W,1%,39.2K	RN55D-39.2K	MILSP	4701-03-3922	1.000
R08	RES,MF,1/8W,1%,61.9K	RN55D-61.9K	MILSP	4701-03-6192	1.000
R09	RES,MF,1/8W,1%,2.15K	RN55D-2.15K	MILSP	4701-03-2151	1.000
R10 R11 R89	RES,MF,1/8W,1%,100K	RN55D-100K	MILSP	4701-03-1003	3.000
R12	RES,C,1/4W,5%,120K	CF1/4-120K	ASE	4700-15-1203	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	Part No.	QTY
R18	RES,MF,1/8W,1%,1.65K	RN55D-1.65K	MILSP	4701-03-1651	1.000
R19 R23 R25 R49	RES,C,1/4W,5%,15K	CF1/4-15K	ASE	4700-15-1502	4.000
R20	RES,C,1/4W,5%,7.5K	CF1/4-7.5K	ASE	4700-15-7501	1.000
R21	RES,C,1/4W,5%,220K	CF1/4220K	ASE	4700-15-2203	1.000
R22	RES,C,1/4W,5%,2K	CF1/4-2K	ASE	4700-15-2001	1.000
R24 R79 R86	RES,C,1/4W,5%,1K	CF1/4-1K	ASE	4700-15-1001	3.000
R26 R46	POT,500	3386W-1-501	BOU	4610-02-0501	2.000
R27	RES,C,1/4W,5%,51	CF1/451	ASE	4700-15-5109	1.000
R28 R29 R38 R39 R61 R80 R85	RES,MF,1/8W,1%,10K	RN55D-10K	MILSP	4701-03-1002	7.000
R30	RES,MF,1/8W,1%,95.3K	RN55D-95.3K	MILSP	4701-03-9532	1.000
R31	RES,MF,1/8W,1%,1.27M	RN55D-1.27M	MILSP	4701-03-1274	1.000
R32 R81	RES,MF,1/8W,1%,649K	RN55D-649K	MILSP	4701-03-6493	2.000
R33	RES,MF,1/8W,1%,324K	RN55D-324K	MILSP	4701-03-3243	1.000
R34	RES,MF,1/8W,1%,162K	RN55D-162K	MILSP	4701-03-1623	1.000
R35	RES,MF,1/8W,1%,80.6K	RN55D-80.6K	MILSP	4701-03-8062	1.000
R36	RES,MF,1/8W,1%,40.2K	RN55D-40.2K	MILSP	4701-03-4022	1.000
R37 R45	RES,MF,1/8W,1%,20K	RN55D-20K	MILSP	4701-03-2002	2.000
R40 R41	RES,MF,1/8W,1%,10.2K	RN55D-10.2K	MILSP	4701-03-1022	2.000
R42	RES,MF,1/8W,1%,10.7K	RN55D-10.7K	MILSP	4701-03-1072	1.000
R43	RES,MF,1/8W,1%,11.5K	RN55D-11.5K	MILSP	4701-03-1152	1.000
R44	RES,MF,1/8W,1%,13.3K	RN55D-13.3K	MILSP	4701-03-1332	1.000
R48	POT,50K	3386W-1-503	BOU	4610-02-0503	1.000
R50	RES,C,1/4W,5%,620K	CB6245	A-B	4700-15-6203	1.000
R51	POT,100K	3386W-1-104	BOU	4610-02-0104	1.000
R52 R77	RES,C,1/4W,5%,100K	CF1/4-100K	ASE	4700-15-1003	2.000
R53	RES,C,1/4W,5%,91K	CF1/4-91K	ASE	4700-15-9102	1.000
R54	RES,MF,1/8W,1%,226	RN55D-226	MILSP	4701-03-2260	1.000
R55	RES,MF,1/8W,1%,9.76K	RN55D-9.76K	MILSP	4701-03-9761	1.000
R56	RES,MF,1/8W,1%,453	RN55D-453	MILSP	4701-03-4530	1.000
R57	RES,MF,1/8W,1%,11.8K	RN55D-11.8K	MILSP	4701-03-1182	1.000
R58	RES,MF,1/8W,1%,4.42K	RN55D-4.42K	MILSP	4701-03-4421	1.000
R59	RES,MF,1/8W,1%,45.3K	RN55D-45.3K	MILSP	4701-03-4532	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	Part No.	QTY
R60	RES,MF,1/8W,1%,1.69K	RN55D-1.69K	MILSP	4701-03-1691	1.000
R62	RES,MF,1/8W,1%,15.4K	RN55D-15.4K	MILSP	4701-03-1542	1.000
R63	RES,MF,1/8W,1%,34.8K	RN55D-34.8K	MILSP	4701-03-3482	1.000
R64 R75 R76	RES,C,1/4W,5%,1M	CF1/4-1M	ASE	4700-15-1004	3.000
R65	RES,C,1/4W,5%,2.7K	CF1/4-2.7K	ASE	4700-15-2701	1.000
R67	RES,C,1/4W,5%,18K	CF1/4-18K	ASE	4700-15-1802	1.000
R68	RES,C,1/4W,5%,3.9K	CF1/43.9K	ASE	4700-15-3901	1.000
R71 R72	RES,C,1/4W,5%,33K	CF1/4-33K	ASE	4700-15-3302	2.000
R74	RES,C,1/4W,5%,47K	CF1/4-47K	ASE	4700-15-4702	1.000
R78	RES,C,1/4W,5%,180K	CF1/4-180K	ASE	4700-15-1803	1.000
R83	RES,C,1/4W,5%,20K	CF1/4-20K	ASE	4700-15-2002	1.000
R84	RES,C,1/4W,5%,39K	CF1/4-39K	ASE	4700-15-3902	1.000
R88	RES,1/8W,1%, 49.9K	RN55D-49.9K	MILSP	4701-03-4992	1.000
R90	RES,MF,1/8W,1%,3.01K	RN55D-3.01K	MILSP	4701-03-3011	1.000
R91 R94	POT,5K	3386W-1-502	BOU	4610-02-0502	2.000
R92 R93	RES,MF,1/8W,1%,13.7K	RN55D-13.7K	MILSP	4701-03-1372	2.000
R96	RESISTOR,VARIABLE1K	3386W-1-102	BOU	4610-02-0102	1.000
R98	RES,C,1/4W,5%,30K	CF1/4-30K	ASE	4700-15-3002	1.000
R99	RES,MF,1/8W,1%,5.49K	RN55D-5.49K	MILSP	4701-03-5491	1.000
RP01	RES NTWK,SIP,9-10K	109-103J	EPITK	4770-00-0012	1.000
RP02	RES NTWK,SIP,9-4.7K	109-472J	EPITK	4770-00-0014	1.000
RP03	RES NTWK,SIP,6-10K	CSC06A01-103K	DALE	4770-00-0028	1.000
TP01	TESTPOINTS-	2520B-1	USECO	2112-19-0005	1.000
U01 U24	DUAL CNTR, STATIC SENSITIVE	CD4518BE	RCA	8000-45-1810	2.000
U02 U03 U26	DCD/DEC DCDR STATIC SENSITIVE	CD4013BE	RCA	8000-40-1312	3.000
U04	MICROPROCESSOR STATIC SENSITIVE	CDP1802CE	RCA	8000-18-0210	1.000
U05 U21 U31 U32 U35 U38 U39 U40 U42	DUAL OP AMP STATIC SENSITIVE ¥2	TL082CP	T-I	7000-00-8200	9.000
U07	QUAD NAND STATIC SENSITIVE	MC14011BCP	MOT	8001-40-1112	1.000
U08	GATES,STAT SENSITIVE	CD4073BE	RCA	8000-40-7300	1.000
U06 - See Page 5					
U30 - See Page 5					

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	Part No.	QTY
U09 U43 U44	QUAD L-H VOLT SHFTR STATIC SENSITIVE	CD40109BE	RCA	8004-01-0910	3.000
U10 U37	HEX INV, CMOS STATIC SENSITIVE	CD40106BE	RCA	8004-01-0610	2.000
U11 U13 U16 U18 U20 U23	QUAD LATCH STATIC SENSITIVE	MC14042BCP	MOT	8001-40-4210	6.000
U12 U15 U17 U19	BCD RATE MULT STATIC SENSITIVE	CD4527BCN	NAT	8000-45-2710	4.000
U14	GENERATOR IC STATIC SENSITIVE #2	TP53130	NAT	7005-31-3010	1.000
U22	NOR GATE,STATIC SENSITIVE	CD4025BE	RCA	8000-40-2520	1.000
U25	QUAD EXCL. OR GATE STATIC SENSITIVE	CD4030BE	RCA	8000-40-3010	1.000
U27	INVERT-AND-OR,STATIC SENSITIVE	CD4086BE	RCA	8000-40-8620	1.000
U28 U29	UP/DOWN COUNTER STATIC SENSITIVE	CD4510BE	RCA	8000-45-1002	2.000
U33 U34 U36	QUAD SPST SWITCH STATIC SENSITIVE	DG308	SCX	7000-03-0800	3.000
U41	RMS/DC CONVERTER STATIC SENSITIVE	AD636JH	A-D	7000-06-3610	1.000
U45	PROM, STATICSENSITIVE	DM74S288N	NAT	8007-42-8800	1.000
Y01	CRYSTAL,3.579545 MHZ	MPC18-3.579545MHZ	NEL	2310-00-1190	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG MFGR PART NO.	MFGR	PART NUMBER	QTY
U06	E PROM	MM2716	NAT	8000-25-1610	1.000
U30	PROM	74S471	NAT	8007-44-7110	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	Part No.	QTY
C01 C11 C15 C32 C35 C36 C39 C40 C47	CAP,MON,50V,.01UF	CW15C103K	C-L	1510-14-4103	9.000
C02 C10	CAP,DISC,1KV,.001UF	5GAD10	SPR	1510-10-1102	2.000
C04 C14 C30 C67 C68	CAP,TANT,20V,10UF	196D106X9020JA1	SPR	1510-25-2100	5.000
C05	CAP,ELEC,25V,2200UF	39D228G025HP4	SPR	1510-25-7222	1.000
C06	CAP,ELEC,25V,4000UF	TCG4024025L3C	MAL	1510-25-8402	1.000
C07	CAP,ELEC,15V,8000UF	TCG8024015N2L	MAL	1510-25-9802	1.000
C08	CAP,MICA,500V,470PF	DM15-471J	ARC	1510-50-0471	1.000
C09	CAP,MICA,500V,100PF	DM15-101J	C-D	1510-50-0101	1.000
C13 C17 C22 C23 C27 C28 C29 C44 C45 C46	CAP,DISC,.05UF	UK25-503	C-L	1510-14-1503	10.000
C16 C66	CAP,TANT,35V,1UF	196D105X9035HA1	SPR	1510-25-3109	2.000
C18 C19 C20 C21	CAP,MICA,500V,.001UF	DM15-102J	ARC	1510-50-0102	4.000
C24	CAP,MON,50V,.22UF	8131-050-151-224M	ETP	1510-14-6224	1.000
C25	CAP,TANT,35V,4.7UF	196D475X9035JA1	SPR	1510-25-3479	1.000
C26	CAP,MICA,500V,330PF	DM15-331J	ARC	1510-50-0331	1.000
C31	CAP,MON,50V,33PF	RA50-330JA	MURGA	1510-11-8330	1.000
C33	CAP,MICA,500V,75PF	CM05ED750J03	C-D	1510-50-0750	1.000
C34	CAP,MICA,500V,10PF	CM05CD100D03	SPR	1510-50-8100	1.000
C37 C41	CAP,MICA,500V,33PF	CM05ED330J03	SPR	1510-50-0330	2.000
C38 C42	CAP,COMP,500V,4.7PF	MC-4.7PF	Q-C	1510-40-1479	2.000
C48	CAP,MON,50V,8.2PF	C312C829D2G5CA	UNCAR	1510-11-8829	1.000
C49	CAP,MON,50V,27PF	RA50-270JA	MURGA	1510-11-8270	1.000
C50 C51	CAP,MON,50V,82PF	RA50-820JA	MURGA	1510-11-8820	2.000
C53 C54 C59	CAP,DISC,.01UF	UK25-103	C-L	1510-14-1103	3.000
C55 C63	CAP,MON,50V,360PF	RPE110C0G361J50V	MURGA	1510-11-8361	2.000
C56 C57	CAP,MON,50V,.0018UF	CN30A182K	CRL	1510-11-8182	2.000
C58	CAP,MON,50V,.1UF	C320C104M5U1CA	UNCAR	1510-11-3104	1.000
C60 C62	CAP,MON,50V,.01UF	CN30C103K	CRL	1510-11-8103	2.000
C61	CAP,MON,50V,3.3PF	C312C339D2G5CA	UNCAR	1510-11-8339	1.000
C64 C65	CAP,MON,50V,680PF	RPE110C0G681J50V	MURGA	1510-11-8681	2.000
CR01 CR02 CR03 CR04	DIODE STATIC SENSITIVE #2	MR501	MOT	4806-02-0007	4.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	Part No.	QTY
CR07 CR08	DIODE,SIGNAL STATIC SENSITIVE ‡2	1N914	G-E	4807-01-0914	2.000
CR09	DIODE, VARACTOR STATIC SENSITIVE ‡2	SQ151	MOT	4803-02-0012	1.000
CR10	DIODE,ZENER,6V STATIC SENSITIVE ‡2	1N5233	MOT	4801-01-5233	1.000
J01 J02	CONN,RF,STR,JACK	700209	CBLWV	2110-08-0006	2.000
L02 L08	CHOKE,MOLDED,100 UH	1025-68	DEL	1810-10-0101	2.000
L03	INDUCTOR,VAR. 6-1/2T FROM:1813-00-0050	1210-32-0026	W-I	1210-32-0026	1.000
L04 L05	INDUCTOR,VAR. 4T FROM:1813-00-0050	1210-32-0027	W-I	1210-32-0027	2.000
L06	CHOKE	VK20010/3B	FRXC	1810-09-0001	1.000
L07 - See Page 5 Q02 Q03 Q04 Q07 Q08 Q09	TRANSISTOR STATIC SENSITIVE ‡2	PN2222	NAT	4901-02-2220	6.000
Q05 Q10	TRANSISTOR STATIC SENSITIVE ‡2	PN4356-5	NAT	4901-04-3560	2.000
R01	RES,C,1/4W,5%,6.8K	CF1/4-6.8K	ASE	4700-15-6801	1.000
R02 R33	RES,C,1/4W,5%,1M	CF1/4-1M	ASE	4700-15-1004	2.000
R03 R16 R56 R79 R80 R86	RES,C,1/4W,5%,4.7K	CF1/4-4.7K	ASE	4700-15-4701	6.000
R04 R23	RES,MF,1/8W,1%,6.19K	RN55D-6.19K	MILSP	4701-03-6191	2.000
R05 R11	RES,MF,1/8W,1%,3.83K	RN55D-3.83K	MILSP	4701-03-3831	2.000
R06	POT,1K,RP130-210	89PR1K	BEK	4610-00-2102	1.000
R07	RES,MF,1/8W,1%,13.7K	RN55D-13.7K	MILSP	4701-03-1372	1.000
R08	RES,C,1/4W,5%,1.5K	CF1/4-1.5K	ASE	4700-15-1501	1.000
R09	RES,MF,1/8W,1%,3.40K	RN55D-3.40K	MILSP	4701-03-3401	1.000
R10 R14	POT,CERMET,500	89PR500	BEK	4610-00-2501	2.000
R12	RES,C,1/2W,5%,220	CF1/2-220	ASE	4700-25-2200	1.000
R13	RES,MF,1/8W,1%,2.21K	RN55D-2.21K	MILSP	4701-03-2211	1.000
R15	RES,MF,1/8W,1%,750	RN55D-750	MILSP	4701-03-7500	1.000
R17	POT,5K	3386W-1-502	BOU	4610-02-0502	1.000
R18	RES,C,1/4W,5%,3.3M	CF1/4-3.3M	ASE	4700-15-3304	1.000
R19 R83	RES,C,1/4W,5%,1.1M	RCF 1X1M-QB	CII	4700-15-1104	2.000
R20	RES,C,1/4W,5%,510	CF1/4-510	ASE	4700-15-5100	1.000
R22 R24 R35 R81 R84 R85	RES,C,1/4W,5%,100	CF1/4-100	ASE	4700-15-1000	6.000
R25 R26 R29 R30 R87	RES,C,1/2W,5%,1	CF1/2-1	ASE	4700-25-1008	5.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	Part No.	QTY
R27	RES,MF,1/8W,1%,1.96K	RN55D-1.96K	MILSP	4701-03-1961	1.000
R28	RES,C,1/4W,5%,470	CF1/4-470	ASE	4700-15-4700	1.000
R31	RES,C,1/4W,5%,180	CF1/4-180	ASE	4700-15-1800	1.000
R32 R49 R53	RES,C,1/4W,5%,10K	CF1/4-10K	ASE	4700-15-1002	3.000
R36	RES,C,1/4W,5%,11K	RCF-11K-QB	CII	4700-15-1102	1.000
R37	RES,MF,1/8W,1%,1.1K	RN55D-1.1K	MILSP	4701-03-1101	1.000
R38 R55 R58	RES,MF,1/8W,1%,10K	RN55D-10K	MILSP	4701-03-1002	3.000
R39	RES,MF,1/8W,1%,39.2K	RN55D-39.2K	MILSP	4701-03-3922	1.000
R40	RES,MF,1/8W,1%,133K	RN55D-133K	MILSP	4701-03-1333	1.000
R41	RES,MF,1/8W,1%,205K	RN55D-205K	MILSP	4701-03-2053	1.000
R42	RES,MF,1/8W,1%,7.15K	RN55D-7.15K	MILSP	4701-03-7151	1.000
R43 R47	RES,C,1/4W,5%,47K	CF1/4-47K	ASE	4700-15-4702	2.000
R44 R46	RES,MF,1/8W,1%,499	RN55D-499	MILSP	4701-03-4990	2.000
R45	RES,MF,1/8W,1%,75K	RN55D-75K	MILSP	4701-03-7502	1.000
R48	RES,C,1/4W,5%,82K	CF1/4-82K	ASE	4700-15-8202	1.000
R50 R51	RES,MF,1/8W,1%,100K	RN55D-100K	MILSP	4701-03-1003	2.000
R52	RES,C,1/4W,5%,10M	CB1065	A-B	4700-15-1005	1.000
R54 R82	RES,C,1/4W,5%,240	RCF-240-QB	CII	4700-15-2400	2.000
R57 R60	RES,MF,1/8W,1%,10.2K	RN55D-10.2K	MILSP	4701-03-1022	2.000
R59	RES,MF,1/8W,1%,1K	RN55D-1K	MILSP	4701-03-1001	1.000
R61	RES,MF,1/8W,1%,3.01K	RN55D-3.01K	MILSP	4701-03-3011	1.000
R62	RES,MF,1/8W,1%,24.3K	RN55D-24.3K	MILSP	4701-03-2432	1.000
R63	RES,MF,1/8W,1%,4.75K	RN55D-4.75K	MILSP	4701-03-4751	1.000
R64	RES,MF,1/8W,1%,11.0K	RN55D-11.0K	MILSP	4701-03-1102	1.000
R65	RES,C,1/4W,5%,1K	CF1/4-1K	ASE	4700-15-1001	1.000
R66	RES,C,1/4W,5%,3.0M	CB3055	A-B	4700-15-3004	1.000
R67	RES,C,1/4W,5%,5.1K	CF1/4-5.1K	ASE	4700-15-5101	1.000
R68 R72	RES,C,1/4W,5%,33	CF1/4-33	ASE	4700-15-3309	2.000
R69 R73	RES,C,1/4W,5%,3.3K	CF1/4-3.3K	ASE	4700-15-3301	2.000
R70 R74	RES,C,1/4W,5%,3.9K	CF1/43.9K	ASE	4700-15-3901	2.000
R71 R75	RES,C,1/4W,5%,1.8K	CF1/4-1.8K	ASE	4700-15-1801	2.000
R76 R78	RES,C,1/4W,5%,75	CR1/4-75	ASE	4700-15-7509	2.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	Part No.	QTY
R77	RES,C,1/4W,5%,150	CF1/4-150	ASE	4700-15-1500	1.000
TP01 TP02 TP03 TP04 TP05 TP06 TP07 TP08 TP09	TESTPOINTS-	2520B-1	USECO	2112-19-0005	9.000
U01 U03	DUAL MONOST/MVBTR STATIC SENSITIVE	DM74123N	NAT	8007-41-2300	2.000
U02	DECADE COUNTER STATIC SENSITIVE	MM74C90	NAT	8000-74-9010	1.000
U04	DUAL D-FLIP FLOP STATIC SENSITIVE	SN74LS74AN	T-I	8000-74-7411	1.000
U05	DECADE COUNTER STATIC SENSITIVE	DM74LS90	NAT	8000-74-9011	1.000
U06 U07 U08	VOLTAGE REGULATOR STATIC SENSITIVE #2	LM723CN	NAT	7000-07-2300	3.000
U09	DUAL OP AMP STATIC SENSITIVE #2	TL082CP	T-I	7000-00-8200	1.000
U10	IC,IL004-001 STATIC SENSITIVE #2	LM339N	NAT	7000-03-3900	1.000
U11	HEX INVERTER STATIC SENSITIVE	SN74LS04N	T-I	8000-74-0410	1.000
U12	OP AMP, BIMOS STATIC SENSITIVE	CA3140E	RCA	7000-31-4001	1.000
U13	QUAD EXCL-OR STATIC SENSITIVE	SN74LS86N	T-I	8000-74-8610	1.000
U14	COUNTE,BINARY,4-BIT STATIC SENSITIVE	SN74LS93	MOT	8000-74-9310	1.000
U15	OP AMP STATIC SENSITIVE #2	LF351N	NAT	7000-00-8100	1.000
U16	PO VOLTAGE REG. STATIC SENSITIVE #2	UA7805UC	FCD	7000-78-0523	1.000
Y01	TCXO,10 MHZ	TCX050-17A	ISTMP	2311-00-0007	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG MFGR PART NO	MFGR	PART NUMBER	QTY
L07	INDUCTOR, VAR, 7T	1210-32-0024	N-1	1210-32-0024	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	Parts No.	QTY
C01 C15	CAP,MICA,500V,12PF	CM05CD120J03	SPR	1510-50-8120	2.000
C02 C12 C13 C48	CAP,FILM,250V,.22UF	160/.22/K/250/F	WSTLK	1510-62-3224	4.000
C03	CAP,ELEC,25V,100UF	TE1211	SPR	1510-20-4101	1.000
C04	CAP,ELEC,16V,470UF	ECEB1CV471S	PNSNC	1510-25-8471	1.000
C05 C60	CAP,TANT,20V,10UF	196D106X9020JA1	SPR	1510-25-2100	2.000
C06 C08 C10 C18 C19 C35 C42 C43 C56	CAP,DISC,.01UF	UK25-103	C-L	1510-14-1103	9.000
C07 C59 C61	CAP,MON,50V,1UF	3420-050-E105M	AER	1510-11-3105	3.000
C09	CAP,FILM,.1 UF	225P010491WD3	SPR	1510-61-7104	1.000
C11 C29	CAP,FILM,.012 UF	2225P12391WD3	SPR	1510-61-7123	2.000
C14	CAP,DISC,3KV,.01UF	DD30-103	C-L	1510-14-0103	1.000
C16	CAP,DISC,25V,.1UF	UK25-104	C-L	1510-14-1104	1.000
C17 C36 C57	CAP,ELEC,16V,100UF	20YH100	MOUS	1510-27-6101	3.000
C21 C34 C55	CAP,TANT,35V,1UF	196D105X9035HA1	SPR	1510-25-3109	3.000
C22 C30 C31 C40	CAP,FILM,.0027 UF	225P27291WD3	SPR	1510-61-7272	4.000
C24	CAP,FILM,250V,.082UF	160/.082/K/250/C	PLSSY	1510-62-3823	1.000
C25 C49	CAP,FILM,.022 UF	225P2239S1WD3	SPR	1510-61-7223	2.000
C26 C28	CAP,FILM,.0012 UF	225P12291WD3	SPR	1510-61-7122	2.000
C27	CAP,MICA,500V,120PF	DM15-121J	ARC	1510-50-0121	1.000
C32	CAP,MICA,500V,330PF	DM15-331J	ARC	1510-50-0331	1.000
C33	CAP,MICA,500V,390PF	DM-15-391J	ARC	1510-50-0391	1.000
C37	CAP,MICA,500V,150PF	CM05FD151J03	SPR	1510-50-0151	1.000
C38 C41 C52	CAP,FILM,.0047 UF	225P47291WD3	SPR	1510-61-7472	3.000
C39	CAP,MICA,500V,220PF	DM-15-221J	ARC	1510-50-0221	1.000
C44	CAP,TANT,35 V,3.3 UF	196D335X9035JA1	SPR	1510-25-3339	1.000
C45	CAP,MICA,500V,10PF	CM05CD100D03	SPR	1510-50-8100	1.000
C46 C53	CAP,TANT,35V,4.7UF	196D475X9035JA1	SPR	1510-25-3479	2.000
C47	CAP,TANT,35V,.47UF	196D474X9035HA1	SPR	1510-25-3478	1.000
C50	CAP,FILM,.0022 UF	225P22291WD3	SPR	1510-61-7222	1.000
C51	CAP,FILM,63V,.047UF	168/.047/K/63/A	WSTLK	1510-63-9473	1.000
C54	CAP,MICA,500V,82PF	CM05ED820J03	SPR	1510-50-0820	1.000
C58	CAP,TANT,35V,2.2 UF	196D225X9035JA1	SPR	1510-25-3229	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	Part No.	QTY
CR01	DIODE,ZENER,9.1V STATIC SENSITIVE #2	1N5239	MOT	4801-01-5239	1.000
CR02 CR04	DIODE,RECT,400V STATIC SENSITIVE #2	1N4004	P-C	4806-01-4004	2.000
CR03	DIODE,ZENER,75V STATIC SENSITIVE #2	1N5267	MOT	4801-01-5267	1.000
CR05 CR06 CR07 CR08 CR09 CR10 CR11 CR12 CR13 CR14 CR15 CR16	DIODE,SIGNAL STATIC SENSITIVE #2	1N914	G-E	4807-01-0914	12.000
L01 L02 L03	CHOKE	VK20010/3B	FRXC	1810-09-0001	3.000
P01	CONNECTOR,MOLEX	09-66-1071	MOL	2112-08-0033	1.000
Q01	TRANSISTOR STATIC SENSITIVE #2	2N6556	NAT	4901-06-5560	1.000
Q02 Q03 Q04 Q05 Q06 Q09 Q10 Q11 Q12	TRANSISTOR (D) STATIC SENSITIVE #2	2N6557	MOT	4901-06-5570	9.000
Q07 Q14 Q18	TRANSISTOR STATIC SENSITIVE #2	PN4121-18	NAT	4901-04-1210	3.000
Q08	TRANSISTOR STATIC SENSITIVE #2	2N3565	NAT	4901-03-5650	1.000
Q13 Q17 Q19	TRANSISTOR STATIC SENSITIVE #2	PN2222	NAT	4901-02-2220	3.000
Q15 Q16	TRANSISTOR STATIC SENSITIVE #2	PN4275	NAT	4902-04-2750	2.000
R01 R123	RES,C,1/4W,5%,20K	CF1/4-20K	ASE	4700-15-2002	2.000
R02 R109 R53 R63 R66 R84 R87 R88 R89	RES,C,1/4W,5%,10K	CF1/4-10K	ASE	4700-15-1002	9.000
R03 R105 R119 R20 R35 R36	RES,MF,1/8W,1%,10K	RN55D-10K	MILSP	4701-03-1002	6.000
R04 R39	POT,10K	3386W-1-103	BOU	4610-02-0103	2.000
R05	RES,MF,1/8W,1%,21K	RN55D-21K	MILSP	4701-03-2102	1.000
R06	RES,MF,1/8W,1%,56.2K	RN55D-56.2K	MILSP	4701-03-5622	1.000
R07 R42	POT,100K	3386W-1-104	BOU	4610-02-0104	2.000
R08	RES,MF,1/8W,1%,200K	RN55D-200K	MILSP	4701-03-2003	1.000
R09	RES,MF,1/8W,1%,100K	RN55D-100K	MILSP	4701-03-1003	1.000
R10	RES,C,1/4W,5%,15K	CF1/4-15K	ASE	4700-15-1502	1.000
R11 R12 R21 R22 R51 R52	RES,C,1/4W,5%,68K	CF1/4-68K	ASE	4700-15-6802	6.000
R18 R23 R43 R56	RES,C,1/4W,5%,100K	CF1/4-100K	ASE	4700-15-1003	4.000
R19	RES,MF,1/8W,1%,90.9K	RN55D-90.9K	MILSP	4701-03-9092	1.000
R24	RES,C,1/4W,5%,18K	CF1/4-18K	ASE	4700-15-1802	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	Part No.	QTY
R25	RES,C,1/4W,5%,390K	CF1/4-390K	ASE	4700-15-3903	1.000
R26	RES,C,1/4W,5%,180K	CF1/4-180K	ASE	4700-15-1803	1.000
R27	RES,C,1/4W,5%,51	CF1/451	ASE	4700-15-5109	1.000
R28 R29	RES,C,1/4W,5%,150K	CF1/4-150K	ASE	4700-15-1503	2.000
R31	RES,C,1/4W,5%,2.7	CF1/4-2.7	ASE	4700-15-2708	1.000
R32	RES,C,1/4W,5%,1M	CF1/4-1M	ASE	4700-15-1004	1.000
R33	RES,C,1/4W,5%,51K	CF1/4-51K	ASE	4700-15-5102	1.000
R34	POT,50K	3306W-1-503	BOU	4610-02-0503	1.000
R37 R50	RES,C,1/4W,5%,3.3K	CF1/4-3.3K	ASE	4700-15-3301	2.000
R40	RES,C,1/4W,5%,5.6K	CF1/4-5.6K	ASE	4700-15-5601	1.000
R44 R45	RES,C,1/4W,5%,9.1K	CF1/4-9.1K	ASE	4700-15-9101	2.000
R46 R58	RES,C,1/4W,5%,4.7K	CF1/4-4.7K	ASE	4700-15-4701	2.000
R47	RES,C,1/4W,5%,56K	CF1/4-56K	ASE	4700-15-5602	1.000
R48	RES,C,1/4W,5%,330	CF1/4-330	ASE	4700-15-3300	1.000
R49	RES,C,1/4W,5%,11K	RCF-11K-QB	CII	4700-15-1102	1.000
R57	RES,C,1/4W,5%,1.2K	CF1/4-1.2K	ASE	4700-15-1201	1.000
R59	RES,MF,1/8W,1%,24.9K	RN55D-24.9K	MILSP	4701-03-2492	1.000
R62	RES,C,1/4W,5%,22K	CF1/422K	ASE	4700-15-2202	1.000
R65 R70	RES,C,1/4W,5%,39K	CF1/4-39K	ASE	4700-15-3902	2.000
R67 R93	RES,C,1/4W,5%,2K	CF1/4-2K	ASE	4700-15-2001	2.000
R69	RES,C,1/4W,5%,8.2K	CF1/4-8.2K	ASE	4700-15-8201	1.000
R71	RES,MF,1/8W,1%,14.3K	RN55D-14.3K	MILSP	4701-03-1432	1.000
R72	RES,MF,1/8W,1%,182K	RN55D-182K	MILSP	4701-03-1823	1.000
R73	RES,MF,1/8W,1%,511K	RN55D-511K	MILSP	4701-03-5113	1.000
R74	RES,MF,1/8W,1%,105K	RN55D-105K	MILSP	4701-03-1053	1.000
R75	RES,MF,1/8W,1%,52.3K	RN55D-52.3K	MILSP	4701-03-5232	1.000
R76	RES,MF,1/8W,1%,866K	RN55D-866K	MILSP	4701-03-8663	1.000
R77	RES,MF,1/8W,1%,191K	RN55D-191K	MILSP	4701-03-1913	1.000
R78	RES,MF,1/8W,1%,348K	RN55D-348K	MILSP	4701-03-3483	1.000
R79	RES,MF,1/8W,1%,237K	RN55D-237K	MILSP	4701-03-2373	1.000
R80	RES,MF,1/8W,1%,140K	RN55D-140K	MILSP	4701-03-1403	1.000
R81	RES,MF,1/8W,1%,69.8K	RN55D-69.8K	MILSP	4701-03-6982	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	Part No.	QTY
R82	RES,MF,1/8W,1%,357K	RN55D-357K	MILSP	4701-03-3573	1.000
R83	RES,MF,1/8W,1%,80.6K	RN55D-80.6K	MILSP	4701-03-8062	1.000
R85	RES,C,1/4W,5%,36K	CE1/4-36K	ASE	4700-15-3602	1.000
R86	RES,C,1/4W,5%,1.8K	CF1/4-1.8K	ASE	4700-15-1801	1.000
R90	RES,C,1/4W,5%,270K	CF1/4-270K	ASE	4700-15-2703	1.000
R94	RES,C,1/4W,5%,560K	CF1/4-560K	ASE	4700-15-5603	1.000
R96	RES,C,1/4W,5%,2.7K	CF1/4-2.7K	ASE	4700-15-2701	1.000
R97	RES,C,1/4W,5%,12K	CF1/4-12K	ASE	4700-15-1202	1.000
R98	POT,5K	3386W-1-502	BOU	4610-02-0502	1.000
R99	RES,C,1/4W,5%,3.9K	CF1/43.9K	ASE	4700-15-3901	1.000
R100 R101 R106 R108 R17 R64	RES,C,1/4W,5%,270	CF1/4-270	ASE	4700-15-2700	6.000
R102	RES,MF,1/8W,1%,15K	RN55D-15K	MILSP	4701-03-1502	1.000
R103 R60	RES,MF,1/8W,1%,6.19K	RN55D-6.19K	MILSP	4701-03-6191	2.000
R104 R41	RES,C,1/4W,5%,2.2K	CF1/4-2.2K	ASE	4700-15-2201	2.000
R107 R112 R114 R115 R116 R117 R120 R126 R16 R55 R61 R68 R91 R95	RES,C,1/4W,5%,1K	CF1/4-1K	ASE	4700-15-1001	14.000
R110 R38	RES,C,1/4W,5%,470	CF1/4-470	ASE	4700-15-4700	2.000
R111	RES,C,1/4W,5%,150	CF1/4-150	ASE	4700-15-1500	1.000
R113 R121 R54	RES,C,1/4W,5%,47K	CF1/4-47K	ASE	4700-15-4702	3.000
R118	RES,MF,1/8W,1%,30.1K	RN55D-30.1K	MILSP	4701-03-3012	1.000
R122 R30	RES,C,1/4W,5%,10	CF1/4-10	ASE	4700-15-1009	2.000
R124 R125	RES,C,1/2W,5%,1	CF1/2-1	ASE	4700-25-1008	2.000
TP01 TP02 TP03 TP04 TP05 TP06 TP07 TP08 TP09 TP10	TESTPOINTS-	2520B-1	USECO	2112-19-0005	10.000
U01 U02	OP AMP STATIC SENSITIVE ‡2	N5741CV	SIG	7000-57-4100	2.000
U03	POWER AMP, AUDIO STATIC SENSITIVE ‡2	LM380N	NAT	7000-03-8001	1.000
U04 U27	OP AMP STATIC SENSITIVE ‡2	LF351N	NAT	7000-00-8100	2.000
U05 U06 U09 U17	DUAL OP AMP STATIC SENSITIVE ‡2	TL082CP	T-I	7000-00-8200	4.000
U07 U19	QUAD SPST SWITCH STATIC SENSITIVE	DG308	SCX	7000-03-0800	2.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	Part No.	QTY
U08 U15	DUAL MONOST/MVBTR STATIC SENSITIVE	DM74123N	NAT	8007-41-2300	2.000
U10 U16 U20 U21 U22 U24	SPDT ANALOG SWITCH STATIC SENSITIVE	TL607CP	T-I	7000-06-0700	6.000
U11	QUAD POS NAND,SCHMT STATIC SENSITIVE	SN74LS132N	T-I	8007-41-3210	1.000
U12	OP AMP, BIMOS STATIC SENSITIVE	CA3140E	RCA	7000-31-4001	1.000
U13	QUAD POS NAND STATIC SENSITIVE	SN74LS00N	T-I	8000-74-0010	1.000
U14	DUAL J-K FLIP-FLOP STATIC SENSITIVE	DM74LS76AN	NAT	8000-74-7610	1.000
U18	QUAD 2-INPUT OR GATE STATIC SENSITIVE	MM74C32	NAT	8000-74-3211	1.000
U23	QUAD 2-IN AND STATIC SENSITIVE	SN74LS08N	T-I	8000-74-0810	1.000
U25	QUAD EXCL. OR GATE STATIC SENSITIVE	CD4030BE	RCA	8000-40-3010	1.000
U26	PHOTON COUPLED FET	H11F1	G-E	3710-00-0010	1.000

REFERENCE DESICNATORS	PART DESCR1PT1ON	OR1G MFCR PART NO	MFCR	PART NUMBER	QTY
C01, C03, C04, C07, C08, C10	CAP, D1SC, 3KV, .01UF	DD30-103	C-L	1510-14-0103	6.000
C02, C14, C15, C16, C17, C18, C25, C38	CAP, DISC, .05UF	UK25-503	C-L	1510-14-1503	8.000
C09, C11	CAP, D1SC, 2KV, .25UF	KM9-20-250	FC1	1510-14-2254	2.000
C06	CAP, D1SC, .22UF	4PS-P22	SPR	1510-14-3224	1.000
C13, C26	CAP, TANT, 20V, 10UF	196D106X9020JA1	SPR	1510-25-2100	2.000
C39	CAP, TANT, 20V, 15UF	196D156X9020KA1	SPR	1510-25-2150	1.000
C32	CAP, TANT, 35V, 1UF	196D105X9035HA1	SPR	1510-25-3109	1.000
C34	CAP, TANT, 35V, 2.2UF	196D225X9035JA1	SPR	1510-25-3229	1.000
C05	CAP, ELEC, 300V, 120UF	39D127F300HS4	SPR	1510-25-5121	1.000
C40, C41, C42	CAP, ELEC, 16V, 100UF	ECEB1CV101S	PNSNC	1510-25-8102	3.000
C33	CAP, M1CA, 500V, .001UF	DM15-102J	ARC	1510-50-0102	1.000
C12	CAP, MICA, 500V, 220PF	DM-15-221J	ARC	1510-50-0221	1.000
C19	CAP, FILM, .0047 UF	225P47291WD3	SPR	1510-61-7472	1.000
	DS PC BOARD			1717-00-0068	1.000
	IC SKT, 8 PIN	DILB-8P-108	BURND	2112-00-0007	3.000
	IC SKT, PC, 14 PIN MC000-073	C931402	T-I	2112-00-0011	3.000
	IC SKT, 16 PIN MC000-074	DILB-16P-108	BURND	2112-00-0012	2.000
J01	PLUG, 6-PIN KONEKTON MC000-075	09-65-1061	MOL	2112-05-0002	1.000
J02	CONNECTOR, MOLEX	09-66-1121	MOL	2112-08-0036	1.000
	CARD EJECTOR	105	CLMRK	2112-12-0059	2.000
TP01, TP02, TP03, TP05, TP06	TESTPOINTS	2520B-1	USECO	2112-19-0005	5.000
	CABLE TIE, 5-1/2	T181	TYTON	2810-00-0016	3.000
R56	RESISTOR, VARIABLE 1K	3386W-1-102	BOU	4610-02-0102	1.000
R04, R51	POT, 10K	3386W-1-103	BOU	4610-02-0103	2.000
R03, R54	POT, 100K	3386W-1-104	BOU	4610-02-0104	2.000
R52	POT, 500	3386W-1-501	BOU	4610-02-0501	1.000
R53, R55	POT, 5K	3386W-1-502	BOU	4610-02-0502	2.000
R90	RES, C, 1/4W, 5%, 1K	CF1/4-1K	ASE	4700-15-1001	1.000
R47	RES, C, 1/4W, 5%, 10K	CF1/4-10K	ASE	4700-15-1002	1.000
R22, R23, R24, R25, R26, R77, R92	RES, C, 1/4W, 5%, 1M	CF1/4-1M	ASE	4700-15-1004	7.000
R48	RES, C, 1/4W, 5%, 120	CF1/4-120	ASE	4700-15-1200	1.000
R05, R06	RES, C, 1/4W, 5%, 180K	CF1/4-180K	ASE	4700-15-1803	2.000
R27	RES, C, 1/4W, 5%, 18	CF1/4-18	ASE	4700-15-1809	1.000
R72, R93	RES, C, 1/4W, 5%, 2K	CF1/4-2K	ASE	4700-15-2001	2.000
R07	RES, C, 1/4W, 5%, 20K	CF1/4-20K	ASE	4700-15-2002	1.000
R30, R46	RES, C, 1/4W, 5%, 2.2K	CF1/4-2.2K	ASE	4700-15-2201	2.000
R62	RES, C, 1/4W, 5%, 22K	CF1/4-22K	ASE	4700-15-2202	1.000
R08	RES, C, 1/4W, 5%, 22M	CF1/4-22M	ASE	4700-15-2205	1.000
R32	RES, C, 1/4W, 5%, 33K	CF1/4-33K	ASE	4700-15-3302	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIC MFGR PART NO	MFGR	PART NUMBER	QTY
R68	RES, C, 1/4W, 5%, 36K	CE1/4-36K	ASE	4700-15-3602	1.000
R01, R02	RES, C, 1/4W, 5%, 43K	CF1/4-43K	ASE	4700-15-4302	2.000
R43	RES, C, 1/4W, 5%, 4.7K	CF1/4-4.7K	ASE	4700-15-4701	1.000
R91	RES, C, 1/4W, 5%, 47K	CF1/4-47K	ASE	4700-15-4702	1.000
R31, R49	RES, C, 1/4W, 5%, 4.7M	CB4755	A-B	4700-15-4704	2.000
R11	RES, C, 1/2W, 5%, 820	CF1/2-820	ASE	4700-25-8200	1.000
R10	RES, C, 2W, 5%, 22K	HH2235	A-B	4700-45-2202	1.000
R29, R37, R39	RES, MF, 1/8W, 1%, 10K	RN55D-10K	MILSP	4701-03-1002	3.000
R41, R44	RES, MF, 1/8W, 1%, 10.2K	RN55D-10.2K	MILSP	4701-03-1022	2.000
R38, R40	RES, MF, 1/8W, 1%, 11.0K	RN55D-11.0K	MILSP	4701-03-1102	2.000
R42	RES, MF, 1/8W, 1%, 11.8K	RN55D-11.8K	MILSP	4701-03-1182	1.000
R69	RES, MF, 1/8W, 1%, 12.1K	RN55D-12.1K	MILSP	4701-03-1212	1.000
R12	RES, MF, 1/8W, 1%, 169K	RN55D-169K	MILSP	4701-03-1693	1.000
R13, R33, R34	RES, MF, 1/8W, 1%, 19.6K	RN55D-19.6K	MILSP	4701-03-1962	3.000
R87	RES, MF, 1/8W, 1%, 215K	RN55D-215K	MILSP	4701-03-2153	1.000
R36	RES, MF, 1/8W, 1%, 221K	RN55D-221K	MILSP	4701-03-2213	1.000
R28	RES, MF, 1/8W, 1%, 255K	RN55D-255K	MILSP	4701-03-2553	1.000
R61	RES, MF, 1/8W, 1%, 261K	RN55D-261K	MILSP	4701-03-2613	1.000
R78	RES, MF, 1/8W, 1%, 274K	RN55D-274K	MILSP	4701-03-2743	1.000
R35	RES, MF, 1/8W, 1%, 2.8K	RN55D-2.8K	MILSP	4701-03-2801	1.000
R15	RES, MF, 1/8W, 1%, 301K	RN55D-301K	MILSP	4701-03-3013	1.000
R14	RES, MF, 1/8W, 1%, 392K	RN55D-392K	MILSP	4701-03-3923	1.000
R60	RES, MF, 1/8W, 1%, 30.1K	RN55D-30.1K	MILSP	4701-03-3012	1.000
R67	RES, MF, 1/8W, 1%, 45.3K	RN55D-45.3K	MILSP	4701-03-4532	1.000
R09	RES, MF, 1/8W, 1%, 4.87K	RN55D-4.87K	MILSP	4701-03-4871	1.000
R82	RES, MF, 1/8W, 1%, 523K	RN55D-523K	MILSP	4701-03-5233	1.000
R70	RES, MF, 1/8W, 1%, 7.32K	RN55D-7.32K	MILSP	4701-03-7321	1.000
R45	RES, MF, 1/8W, 1%, 8.45K	RN55D-8.45K	MILSP	4701-03-8451	1.000
R66	RES, MF, 1/8W, 1%, 9.76K	RN55D-9.76K	MILSP	4701-03-9761	1.000
R16, R17, R18, R19, R20, R21, R71	RES, MF, 1/4W, 1%, 261K	RN60D-261K	MILSP	4701-13-2613	7.000
CR16	DIODE, VARACTOR	NV430D10	NEC	4803-02-0017	1.000
CR01, CR02, CR03, CR04, CR07	DIODE, RECT, 800V	ED30015	ETP	4806-01-4006	5.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG MFGR PART NO	MFGR	PART NUMBER	QTY
CR06, CR09, CR10, CR11, CR12	DIODE, RECT, 7000V	G7F-7KV-10MA-150NS	GAL	4806-02-0070	5.000
CR08, CR13, CR14, CR15, CR19	DIODE, SIGNAL	1N914	C-E	4807-01-0914	5.000
CR17, CR18	DIODE, SIGNAL	HSCH1001	H-P	4807-01-6263	2.000
Q01, Q02, Q03, Q04	TRANSISTOR	2N6559	MOT	4901-06-5590	4.000
R81	THRMSTR, 1K	Q81	TLLAB	5310-00-0009	1.000
U05	OP AMP	TL084CP	T-I	7000-00-8400	1.000
U08, U10	QUAD SPST SWITCH STATIC SENSITIVE	DG308	SCX	7000-03-0800	2.000
U02	IC, IL004-001	LM339N	NAT	7000-03-3900	1.000
U11	OP AMP/BUFFER	LF357N	NAT	7000-03-5700	1.000
U07	RMS/DC CONVERTER STATIC SENSITIVE	AD636JH	A-D	7000-06-3610	1.000
U01, U03	OP AMP	N5741CV	SIG	7000-57-4100	2.000
U04	HEX INVERTER STATIC SENSITIVE	MM74C04N	NAT	8000-74-0412	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	Part No.	QTY
C01 C02 C03	CAP,MON,50V,.22UF	8131-050-151-224M	ETP	1510-14-6224	3.000
J01	SOCKET,14 DIP LOW PROFILE	SMO-14-S6T	T-B	2112-00-0067	1.000
R01 R02 R03	RES,C,1/4W,5%,1K	CF1/4-1K	ASE	4700-15-1001	3.000
R04	POT,5K	3386W-1-502	BOU	4610-02-0502	1.000
R05	RES,C,1/4W,5%,1	CF-1/4-1.0	ASE	4700-15-1008	1.000
RP01	RES NTWK,SIP,9-4.7K	109-472J	EPITK	4770-00-0014	1.000
U01 U02 U03	LCD CTLR/DRVR,ALPHAN STATIC SENSITIVE	UPD7225G-00	NEC	8000-72-2510	3.000

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REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	Part No.	QTY
CR03 CR04 CR05 CR11 CR12 CR13 CR16 CR20 CR22 CR23	LED,YL,T-1-3/4 STATIC SENSITIVE ‡2	HLMP-3400	H-P	4810-02-0011	10.000
CR17 CR21	LED,RED,T-1-3/4 STATIC SENSITIVE ‡2	HLMP-3300	H-P	4810-02-0012	2.000
S01 S06	SWITCH,5STA,PER B/P	1820-0017	W-I	5110-00-0033	2.000
S02 S03 S09	SWITCH,3STA PER B/P	1820-0012	W-I	5110-00-0030	3.000
S04 S05 S07 S10 S13 S14 S15	SWITCH,1STA PER B/P	1820-0013	W-I	5102-00-0009	7.000
S08 S11	SWITCH,4STA PER B/P	1820-0011	W-I	5110-00-0029	2.000
S12	SWITCH,2STA PER B/P	1820-0014	W-I	5110-00-0031	1.000
S16	SWITCH,1STA,MOM, PER B/P	1820-0016	W-I	5110-00-0032	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	Part No.	QTY
C01 C22 C23 C24 C25 C26 C27 C28	CAP,DISC,.05UF	UK25-503	C-L	1510-14-1503	8.000
C02 C11	CAP,MON,50V,1UF	3420-050-E105M	AER	1510-11-3105	2.000
C03 C04 C12 C13	CAP,TANT,35V,1UF	196D105X9035HA1	SPR	1510-25-3109	4.000
C05	CAP,MICA,500V,47PF	CM05ED470J03	SPR	1510-50-0470	1.000
C06	CAP,MICA,500V,.001UF	DM15-102J	ARC	1510-50-0102	1.000
C07	CAP,MON,50V,.1UF	C320C104K5R5CA	UNCAR	1510-13-1104	1.000
C08	CAP,FILM,63V,.047UF	168/.047/K/63/A	WSTLK	1510-63-9473	1.000
C10 C31	CAP,TANT,20V,47UF	196D476X9020PE4	SPR	1510-26-4470	2.000
C14 C16	CAP,MICA,500V,220PF	DM-15-221J	ARC	1510-50-0221	2.000
C15	CAP,MICA,500V,27PF	CM05ED270J03	ARC	1510-50-0270	1.000
C17	CAP,MICA,500V,1500PF	DM19-152J	ARC	1510-50-0152	1.000
C18	CAP,MICA,500V,200PF	DM15-201J	S-F	1510-50-0201	1.000
C19	CAP,MICA,500V,100PF	DM15-101J	C-D	1510-50-0101	1.000
C20	CAP,MICA,500V,300PF	DM15-301J	ARC	1510-50-0301	1.000
C21	CAP,MICA,500V,620PF	DM15-621J	ARC	1510-50-0621	1.000
C29	CAP FILM,250V,.068UF	160/.068/K/250/C	WSTLK	1510-61-7683	1.000
C30	CAP,TANT,20V,10UF	196D106X9020JA1	SPR	1510-25-2100	1.000
C32	CAP,MON,50V,10PF	RA50-100DA	MURGA	1510-11-8100	1.000
C33	CAP,MICA,500PF,500V	DM15-501J	ARCO	1510-50-0501	1.000
CR01 CR02 CR06 CR07 CR08 CR09 CR10 CR14 CR15	DIODE,SIGNAL STATIC SENSITIVE ‡2	1N914	G-E	4807-01-0914	9.000
J01	HDR,RA,DUAL,EJECT,60	1-499492-1	AMP	2112-08-0071	1.000
J02	HDR,DBL,STRT,26-PIN	800-583	SPST	2112-08-0066	1.000
L01 L02	CHOKE	VK20010/3B	FRXC	1810-09-0001	2.000
Q01 Q02	TRANSISTOR STATIC SENSITIVE ‡2	PN2222	NAT	4901-02-2220	2.000
Q03	TRANSISTOR STATIC SENSITIVE ‡2	2N3565	NAT	4901-03-5650	1.000
Q04	TRANSISTOR STATIC SENSITIVE ‡2	PN4356-5	NAT	4901-04-3560	1.000
Q05 Q06	TRANSISTOR STATIC SENSITIVE ‡2	PN4275	NAT	4902-04-2750	2.000
R01	RES,C,1/4W,5%,68K	CF1/4-68K	ASE	4700-15-6802	1.000
R02	POT,100K	3386W-1-104	BOU	4610-02-0104	1.000

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REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	Part No.	QTY
R03	RES,C,1/4W,5%,3.3M	CF1/4-3.3M	ASE	4700-15-3304	1.000
R04 R99	RESISTOR,VARIABLE1K	3386W-1-102	BOU	4610-02-0102	2.000
R05	RES,C,1/4W,5%,1.2K	CF1/4-1.2K	ASE	4700-15-1201	1.000
R06 R54 R57 R96	RES,C,1/4W,5%,100	CF1/4-100	ASE	4700-15-1000	4.000
R07	RES,C,1/4W,5%,6.2K	CF1/4-6.2K	ASE	4700-15-6201	1.000
R08 R16	RES,MF,1/8W,1%,21.5K	RN55D-21.5K	MILSP	4701-03-2152	2.000
R09 R15	POT,10K	3386W-1-103	BOU	4610-02-0103	2.000
R10 R17	RES,MF,1/8W,1%,976	RN55D-976	MILSP	4701-03-9760	2.000
R11 R56 R66 R85 R86	RES,C,1/4W,5%,1M	CF1/4-1M	ASE	4700-15-1004	5.000
R12 R13	POT,500	3386W-1-501	BOU	4610-02-0501	2.000
R14	RES,C,1/4W,5%,680K	CF1/4-680K	ASE	4700-15-6803	1.000
R18 R33 R50 R51 R87	RES,C,1/4W,5%,180	CF1/4-180	ASE	4700-15-1800	5.000
R19	RES,C,1/4W,5%,4.7K	CF1/4-4.7K	ASE	4700-15-4701	1.000
R20 R36 R70 R83 R88 R94	RES,C,1/4W,5%,5.1K	CF1/4-5.1K	ASE	4700-15-5101	6.000
R21 R22 R42	RES,C,1/4W,5%,47K	CF1/4-47K	ASE	4700-15-4702	3.000
R23 R27	RES,C,1/4W,5%,12K	CF1/4-12K	ASE	4700-15-1202	2.000
R24	RES,C,1/4W,5%,1.2M	CF1/4-1.2M	ASE	4700-15-1204	1.000
R25	RES,C,1/4W,5%,6.2M	CB6255	A-B	4700-15-6204	1.000
R26	RES,C,1/4W,5%,33K	CF1/4-33K	ASE	4700-15-3302	1.000
R28 R30 R37 R38 R39 R82	RES,C,1/4W,5%,20K	CF1/4-20K	ASE	4700-15-2002	6.000
R29 R31 R32 R46 R47 R90	RES,C,1/4W,5%,680	CF1/4-680	ASE	4700-15-6800	6.000
R34 R89	RES,C,1/4W,5%,15K	CF1/4-15K	ASE	4700-15-1502	2.000
R40 R52	RES,C,1/4W,5%,100K	CF1/4-100K	ASE	4700-15-1003	2.000
R41	RES,C,1/4W,5%,2K	CF1/4-2K	ASE	4700-15-2001	1.000
R43	RES,C,1/4W,5%,56K	CF1/4-56K	ASE	4700-15-5602	1.000
R44 R48 R65 R68 R71 R84 R92	RES,C,1/4W,5%,10K	CF1/4-10K	ASE	4700-15-1002	7.000
R45 R49 R64 R81	RES,C,1/4W,5%,1K	CF1/4-1K	ASE	4700-15-1001	4.000
R55	RES,MF,1/8W,1%,88.7K	RN55D-88.7K	MILSP	4701-03-8872	1.000
R58	POT,2K	3386W-1-202	BOU	4610-02-0202	1.000
R59 R74	RES,MF,1/8W,1%,10.2K	RN55D-10.2K	MILSP	4701-03-1022	2.000
R60	RES,MF,1/8,1%,4.22K	RN55D-4.22K	MILSP	4701-03-4221	1.000
R61	RES,C,1/8W,1%,1.21K	RN55D	MILSP	4701-03-1211	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	Part No.	QTY
R62	RES,MF,1/8W,1%,604	RN55D-604	MILSP	4701-03-6040	1.000
R63	RES,C,1/4W,5%,510	CF1/4-510	ASE	4700-15-5100	1.000
R67	RES,MF,1/8W,1%,13.0K	RN55D-13.0K	MILSP	4701-03-1302	1.000
R69 R93	RES,C,1/4W,5%,560	CF1/4-560	ASE	4700-15-5600	2.000
R72	RES,MF,1/8W,1%,51.1K	RN55D-51.1K	MILSP	4701-03-5112	1.000
R73	RES,1/8W,1%, 49.9K	RN55D-49.9K	MILSP	4701-03-4992	1.000
R75	RES,MF,1/8W,1%,61.9K	RN55D-61.9K	MILSP	4701-03-6192	1.000
R76	RES,MF,1/8W,1%,12.7K	RN55D-12.7K	MILSP	4701-03-1272	1.000
R77	RES,MF,1/8W,1%,78.7K	RN55D-78.7K	MILSP	4701-03-7872	1.000
R78	RES,MF,1/8W,1%,17.8K	RN55D-17.8K	MILSP	4701-03-1782	1.000
R79	RES,MF,1/8W,1%,35.7K	RN55D-35.7K	MILSP	4701-03-3572	1.000
R80	RES,MF,1/8W,1%,13.3K	RN55D-13.3K	MILSP	4701-03-1332	1.000
R91	RES,C,1/4W,5%,2.2M	CF1/4-2.2M	ASE	4700-15-2204	1.000
R95 R97 R98	RES,C,1/4W,5%,150	CF1/4-150	ASE	4700-15-1500	3.000
U01 U05 U08 U09 U10 U14 U15 U16	QUAD SPST SWITCH STATIC SENSITIVE	DG308	SCX	7000-03-0800	8.000
U02 U03 U04 U06 U11 U12	DUAL OP AMP STATIC SENSITIVE #2	TL082CP	T-I	7000-00-8200	6.000
U07	QUAD L-H VOLT SHFTR STATIC SENSITIVE	CD40109BE	RCA	8004-01-0910	1.000
U13	HEX INVERTER STATIC SENSITIVE	MM74C04N	NAT	8000-74-0412	1.000
U17	QUAD 2-IN NAND STAT.SENS.	MM74C00N	NAT	8000-74-0011	1.000
U18	TRIPLE 3-INP NAND STATIC SENSITIVE	MM74C10	NAT	8000-74-1011	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	Part No.	QTY
BT01	BATT,LI,3V	BR2325-1HB	PNSNC	4010-00-0020	1.000
C01	CAP,ELEC,35V,.68UF	196D684X9035HA1	SPR	1510-25-3688	1.000
C02	CAP,ELEC,16V,100UF	20YH100	MOUS	1510-27-6101	1.000
C03 C06 C08 C10 C11 C12 C13 C14 C15 C16 C17 C18 C19 C20 C21 C22 C23 C33 C35	CAP,DISC,.01UF	UK25-103	C-L	1510-14-1103	19.000
C04 C05 CR09	CAP,TANT,35V,1UF	196D105X9035HA1	SPR	1510-25-3109	3.000
C07	CAP,TANT,35V,2.2 UF	196D225X9035JA1	SPR	1510-25-3229	1.000
C24	CAP,MON,50V,.0047UF	CN30C472K	CRL	1510-11-8472	1.000
C25	CAP,MON,50V,.022UF	RA50-223D	MURGA	1510-11-8223	1.000
C26	CAP,MICA,500V,560PF	DM-15-561J	ARC	1510-50-0561	1.000
C27	CAP,FILM,.039 UF	160/.039/K/400/D	PLSSY	1510-61-1393	1.000
C28 C31	CAP,DISC,.05UF	UK25-503	C-L	1510-14-1503	2.000
C29	CAP,FILM,250V,.056UF	160/.056/J/250/C	PLSSY	1510-62-3563	1.000
C30	CAP,MICA,100V,1200PF	1510-50-6122	W-I	1510-50-6122	1.000
C32	CAP,TANT,35V,.47UF	196D474X9035HA1	SPR	1510-25-3478	1.000
C34	CAP,MON,50V,.01UF	CW15C103K	C-L	1510-14-4103	1.000
CR01 CR03 CR04, CR06	DIODE,SIGNAL STATIC SENSITIVE ‡2	1N914	G-E	4807-01-0914	4.000
CR02 CR05	DIODE, SIGNAL STATIC SENSITIVE ‡2	HSCH1001	H-P	4807-01-6263	2.000
J01	HDR,RA,DUAL,EJECT,60	1-499492-1	AMP	2112-08-0071	1.000
J04	CONN,RF,STR,JACK	700209	CBLWV	2110-08-0006	1.000
L01	CHOKE	VK20010/3B	FRXC	1810-09-0001	1.000
R01 R23	RES,C,1/4W,5%,270K	CF1/4-270K	ASE	4700-15-2703	2.000
R02 R28	RES,C,1/4W,5%,10K	CF1/4-10K	ASE	4700-15-1002	2.000
R03 R16	RES,C,1/4W,5%,1M	CF1/4-1M	ASE	4700-15-1004	2.000
R04	RES,C,1/4W,5%,1K	CF1/4-1K	ASE	4700-15-1001	1.000
R05	RES,C,1/4W,5%,470	CF1/4-470	ASE	4700-15-4700	1.000
R06	RES,C,1/4W,5%,200K	CF1/4-200K	ASE	4700-15-2003	1.000
R07 R08 R09 R10 R11 R12 R14 R25 R30	RES,C,1/4W,5%,4.7K	CF1/4-4.7K	ASE	4700-15-4701	9.000
R13 R26	RES,C,1/4W,5%,8.2K	CF1/4-8.2K	ASE	4700-15-8201	2.000
R15 R19	RES,C,1/4W,5%,2.2M	CF1/4-2.2M	ASE	4700-15-2204	2.000

COMTEST PARTS LIST	UPROC BD,A11,3100	1110-70-0067 PAGE: 1	C REV

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	Part No.	QTY
R17	RES,C,1/4W,5%,75K	CF1/4-75K	ASE	4700-15-7502	1.000
R18 R20 R21	RES,C,1/4W,5%,100K	CF1/4-100K	ASE	4700-15-1003	3.000
R22	RES,C,1/4W,5%,51K	CF1/4-51K	ASE	4700-15-5102	1.000
R27	RES,C,1/4W,5%,300K	CF1/4-300K	ASE	4700-15-3003	1.000
R29	RES,C,1/4W,5%,30K	CF1/4-30K	ASE	4700-15-3002	1.000
RP01 RP02	RES NTWK,SIP,5-4.7K	605-472J	EPITK	4770-00-0003	2.000
RP03	RES NTWK,SIP,9-4.7K	109-472J	EPITK	4770-00-0014	1.000
RP04	RES NTWK,SIP,9-10K	109-103J	EPITK	4770-00-0012	1.000
U02	MICROPROCESSOR,8-BIT (2 MHZ) STATIC SEN	MC68B09P	MOT	8000-68-0911	1.000
U03 U18 U19 U20 U21	OCTAL BUF/LN DRVR STATIC SENSITIVE	SN74LS244N	T-I	8007-42-4410	5.000
U04	QUAD POS NAND STATIC SENSITIVE	SN74LS00N	T-I	8000-74-0010	1.000
U05	QUAD BILAT SWITCH STATIC SENSITIVE	CD4016AE	RCA	8000-40-1610	1.000
U06	DUAL COMPARATOR STATIC SENSITIVE #2	LM393N	NAT	7000-03-9310	1.000
U07	HEX INVERTER STATIC SENSITIVE	SN74LS04N	T-I	8000-74-0410	1.000
U08	COUNTE,BINARY,4-BIT STATIC SENSITIVE	SN74LS93	MOT	8000-74-9310	1.000
U09	DEMULTIPLEXER STATIC SENSITIVE	DM74LS156N	NAT	8007-41-5610	1.000
U11	STATIC RAM STATIC SENSITIVE	HM6116LP-4	HIT	8000-61-1610	1.000
U12	SYSTEM TIMING CTLR STATIC SENSITIVE	AM9513PC	AMD	8000-95-1310	1.000
U13	MICROPROCESSOR,PIA (2 MHZ) STATIC SEN	MC68B21P	MOT	8000-68-2111	1.000
U14 U15 U16	DUAL D-FLIP FLOP STATIC SENSITIVE	SN74LS74AN	T-I	8000-74-7411	3.000
U17	OCTAL BUS XVR STATIC SENSITIVE	SN74LS245N	T-I	8007-42-4510	1.000
U22 U23 U24 U25 U26	OCTAL D FLIP-FLOP STATIC SENSITIVE	SN74LS377J	T-I	8007-43-7710	5.000
U27	PO VOLTAGE REG, STATIC SENSITIVE #2	UA7805UC	FCD	7000-78-0523	1.000
U28	DECADE COUNTER STATIC SENSITIVE	MM74C90	NAT	8000-74-9010	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	Part No.	QTY
U29	PHASE LKD. LOOP STATIC SENSITIVE	CD4046AE	RCA	8000-40-4610	1.000
U30	QUAD 2-IN NAND STAT.SENS.	MM74C00N	NAT	8000-74-0011	1.000
U31	QUAD EXCL. OR GATE STATIC SENSITIVE	CD4030BE	RCA	8000-40-3010	1.000
U32	OP AMP STATIC SENSITIVE ₮2	LF351N	NAT	7000-00-8100	1.000
U33	DCDR/DEMUXR STATIC SENSITIVE	SN74LS138N	T-I	8007-41-3810	1.000
S1 - See Page 4					

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG MFGR PART NO	MFGR	PART NUMBER	QTY
S1	SWITCH, DIP 4 POLE	K40-04S	ARE	5112-00-0007	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG MFGR PART NO	MFGR	PART NUMBER	QTY
	A12/SWITCH PLUC ASSY			1219-70-0039	1.000
	HEATSINK, INVERTER			1417-30-0200	1.000
C08, C09, C12, C13	CAP, DISC, 1KV, .01UF	5CA-S10	SPR	1510-10-1103	4.000
C17	CAP, DISC, .05UF	UK25-503	C-L	1510-14-1503	1.000
C03, C16	CAP, MON, 50V, .01UF	CW15C103K	C-L	1510-14-4103	2.000
C06, C07	CAP, TANT, 20V, 100F	196D106X9020JA1	SPR	1510-25-2100	2.000
C02, C04	CAP, TANT, 35V, 1UF	196D105X9035HA1	SPR	1510-25-3109	2.000
C14	CAP, ELECT, 16V, 2200UF	SM16VB2200K	UNCHM	1510-27-3222	1.000
C15	CAP, ELEC, 16V, 100UF	20YH100	MOVS	1510-27-6101	1.000
C01	CAP, FILM, .1UF	225P010491WD3	SPR	1510-61-7104	1.000
C05	CAP, FLIM, .15UF	225P15491XD3	SPR	1510-62-1154	1.000
C11	CAP, FILM, 250V, .22UF	160/.22/K/250/F	WSTLK	1510-62-3224	1.000
	DS PC BD, 3100-A12 FROM: 3210-05-0046			1717-00-0069	1.000
J01	CONN, MALE, 7-PIN	09-80-1073	MOL	2112-05-0016	1.000
	MICA INSULATOR	B08853A001	MOT	2810-11-0004	8.000
	NYLON BUSHING	B51547F005	MOT	2810-11-0005	4.000
	NUT, 4-40X1/4, NP	8003-NP	F-S	2810-14-4104	4.000
	HEX NUT 6-32 CRES. STNLS	70206	F-S	2810-16-0024	4.000
	SCW, PFH, 4-40X5/16 STAINLESS	22223	F-S	2810-23-0052	4.000
	SCW, PFH, 6-32X3/8 STAINLESS	22244	F-S	2810-23-0060	4.000
	WSHR, SPCR, 6, .1401D	97313	F-S	2810-26-0012	4.000
	WASHER, #4, TIN PLATE		W-I	2810-28-0032	4.000
U09	PHOTON COUPLED FET	H11F1	G-E	3710-00-0010	1.000
R23	POT, 10K	3386W-1-103	BOU	4610-02-0103	1.000
R04, R12	POT, 5K	3386W-1-502	BOU	4610-02-0502	2.000
R27, R29, R31, R33	RES, C, 1/4W, 5%, 100	CF1/4-100	ASE	4700-15-1000	4.000
R02, R40, R43	RES, C, 1/4W, 5%, 1K	CF1/4-1K	ASE	4700-15-1001	3.000
R16, R17, R18, R19	RES, C, 1/4W, 5%, 10K	CF1/4-10K	ASE	4700-15-1002	4.000
R09, R41, R42	RES, C, 1/4W, 5%, 100K	CF1/4-100K	ASE	4700-15-1003	3.000
R39	RES, C, 1/4W, 5%, 2K	CF1/4-2K	ASE	4700-15-2001	1.000
R25	RES, C, 1/4W, 5%, 2.2K	CF1/4-2.2K	ASE	4700-15-2201	1.000
R37	RES, C, 1/4W, 5%, 22	CF1/4-22	ASE	4700-15-2209	1.000
R01	RES, C, 1/4W, 5%, 27K	CF1/4-27K	ASE	4700-15-2702	1.000
R15, R20	RES, C, 1/4W, 5%, 3.3M	CF1/4-3.3M	ASE	4700-15-3304	2.000
R34	RES, C, 1/4W, 5%, 4.3	RCF-4.3-QB	CII	4700-15-4308	1.000
R08	RES, C, 1/4W, 5%, 4.7K	CF1/4-4.7K	ASE	4700-15-4701	1.000
R36	RES, C, 1/4W, 5%, 470K	CF1/4-470K	ASE	4700-15-4703	1.000
R38	RES, C, 1/4W, 5%, 5.1K	CF1/4-5.1K	ASE	4700-15-5101	1.000
R10	RES, C, 1/4W, 5%, 51K	CF1/4-51K	ASE	4700-15-5102	1.000
R06, R14, R21	RES, MF, 1/8W, 1%, 10K	RN55D-10K	MILSP	4701-03-1002	3.000
R11	RES, MF, 1/8W, 1%, 18.2K	RN55D-18.2K	MILSP	4701-03-1822	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG MFGR PART NO	MFGR	PART NUMBER	QTY
R03	RES, MF, 1/8W, 1%, 20K	RN55D-20K	MILSP	4701-03-2002	1.000
R07	RES, MF, 1/8W, 1%, 221K	RN550-221K	MILSP	4701-03-2213	1.000
R05	RES, MF, 1/8W, 1%, 26.7K	RN55D-26.7K	MILSP	4701-03-2672	1.000
R13	RES, MF, 1/8W, 1%, 30.1K	RN55D-30.1K	MILSP	4701-03-3012	1.000
R22	RES, 1/8W, 1%, 49.9K	RN550-49.9K	MILSP	4701-03-4992	1.000
R24	RES, MF, 1/8W, 1%, 61.9K	RN550-61.9K	MILSP	4701-03-6192	1.000
R26, R28, R30, R32	RES, WW, 3W, 1%, 1	RS2B-3W-1-1%	DAL	4702-55-1008	4.000
CR03	OI00E, ZENER, 6.2V	1N4735	MOT	4801-01-4735	1.000
CR07	OI00E	MR501	MOT	4806-02-0007	1.000
CR01, CR02, CR04, CR05, CR06	OI0DE, SIGNAL	1N914	G-E	4807-01-0914	5.000
Q01	TRANSISTOR	PN2222	NAT	4901-02-2220	1.000
Q02	TRANSISTOR	2N4403	NAT	4901-04-4030	1.000
Q03, Q05, Q07, Q09	TRANSISTOR	TIP35C	MOT	4902-00-0350	4.000
Q04, Q06, Q08, Q10	TRAN, MOSFET STATIC SENSITIVE	IRF531	IREC	4902-00-5310	4.00
	WIRE, 22, RD FROM: 6012-12-2999			6012-12-2222	15.000
	WIRE, 22, WH	MIL-W-16878D-B-22-WH	MILSP	6012-12-2999	15.000
	WIRE, 14, UL1015, BL	UL1015-14-BK	ULSP	6013-11-4000	10.000
	WIRE, 14, UL1015, RD	UL1015-14-RD	ULSP	6013-11-4222	10.000
U08	OP AMP	LF351N	NAT	7000-00-8100	1.000
U05	DUAL OP AMP	TL082CP	T-I	7000-00-8200	1.000
U01	TIMER	MC1455P1	MOT	7000-14-5500	1.000
U07	QUAD 2-IN NAND STAT. SENS.	MM74C00N	NAT	8000-74-0011	1.000
U03, U04, U06	QUAD 2-INP POS NOR STATIC SENSITIVE	DM74C02	NAT	8000-74-0211	3.000
U02	OUAL J-K FLIP-FLOP STATIC SENSITIVE	MM74C76	NAT	8000-74-7611	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG MFGR PART NO	MFGR	PART NUMBER	QTY
CR05, CR06	OIOOE, RECTIFIER STATIC SENSITIVE	1N5825	MOT	4806-01-5825	2.000
J01	HDR, DBL, STRT, 26 PIN	800-583	SPST	2112-08-0066	1.000
J02	CONNECTOR, MOLEX	09-66-1061	MOL	2112-08-0032	1.000
Q01	TRAN, MOSFET STATIC SENSITIVE	IRF531	IREC	4902-00-5310	1.000
Q03	TRANSISTOR, POWER (O) STATIC SENSITIVE	T1P31	MOT	4902-00-0311	1.000
R01, R02	RES, C, 1/4W, 5%, 56K	CF1/4-56K	ASE	4700-15-5602	2.000
R03	RES, C, 1/4W, 5%, 15K	CF1/4-15K	ASE	4700-15-1502	1.000
R04	RES, C, 1/4W, 5%, 680	CF1/4-680	ASE	4700-15-6800	1.000
R05	RESISTOR, VARIABLE 1K	3386W-1-102	BOU	4610-02-0102	1.000
R06	RES, C, 1/4W, 5%, 51	CF1/4-51	ASE	4700-15-5109	1.000
R07	RES, C, .1W, 5%, 33	GB3305	A-B	4700-35-3309	1.000
U01	VOLTAGE REG, 12 STATIC SENSITIVE	LM78L12ACZ	NAT	7000-78-1220	1.000
XA01, XA02, XA03, XA04, XA05, XA07, XA08	PC EDGE CONN, GOLO	530666-6	AMP	2112-27-0010	7.000
XA06	PC EDGE CONN, 72-CKT	1-530666-0	AMP	2112-27-0011	1.000
XP01	CABLE ASSY, RIBBON MOTHER BE/CPU	6011-60-0046	W-I	6011-60-0046	1.000
XP02	CABLE ASSY, RIBBON MOTHER BD/A10	6011-60-0047	W-I	6011-60-0047	1.000
Q2	TRANS, POWER	TIP32	MOT	4902-00-0321	1.000

ABBR.	NAME.....	CITY.....	ST	FSCM.
A-B	ALLEN-BRADLEY	MILWAUKEE	WI	01121
A-D	ANALOG DEVICES	CAMBRIDGE	MA	24355
A-H	ARROW HART, INC.	KETTERING	OH	07858
A-I	ALAN INDUSTRIES	COLUMBUS	IN	52750
A-M	AMERICAN MAGNETICS	CARTERVILLE	IL	12715
A-P	AMERICAN PLASTICRAFT CO.	CHICAGO	IL	53628
ABAC	ABACUS PACKAGING CO.	CHICAGO	IL	
ACEIN	ACE INDUSTRIAL HDWR.	CAMDEN	NJ	
ACI	ADVANCE COMPONENTS, INC.	CENTERBROOK	CT	28102
AEG-T	AEG-TELEFUREN CORP.	SOMERVILLE	NJ	24972
AEP	APPLIED ENG PRODUCTS	NEW HAVEN	CT	19505
AER	AVX CERAMICS	MYRTLE BEACH	SC	96095
AERTK	AERTECH INDUSTRIES	SUNNYVALE	CA	21847
AFE	ACCESSORIES FOR ELECTRONICS	BALDWIN	NY	
AHAM	AHAM COMPANY	AZUSA	CA	53894
AIN	ALPHA INDUSTRIES, INC.	WOBURN	MA	17540
ALC	ALCO ELECTRONICS PRODUCTS	NORTH ANDOVER	ME	95146
ALLPL	ALL PLASTICS,INC.	INDIANAPOLIS	IN	
ALMPT	ALPHA METALS, INC	JERSEY CITY	NJ	96613
AMATM	AMATOM ELEC HDWE CO	NEW HAVEN	CT	
AMD	ADVANCED MICRO DEVICES INC.	SUNNYVALE	CA	34335
AMELC	AMERICAN ELECTRIC CORDSETS	BENSENVILLE	IL	0
AMP	AMP, INC.	HARRISBURG	PA	00779
ANSLY	ANSLEY ELECTRONICS LTD	DOWNSVILLE, ONT., CANADA	**	
ANZAC	ADAMS-RUSSELL,ANZAC DIV	BURLINGTON	MA	
APL	AMPHENOL CONNECTOR SYSTEMS	BROADVIEW	IL	74868
APP	A-P PRODUCTS	PAINESVILLE	OH	0
APX	AMPEREX ELECTRONIC CORP.	SLATERSVILLE	RI	25403
ARC	ARCO ELECTRIC PRODUCTS	SHELBYVILLE	IN	24652
ARIES	ARIES ELECTRONICS CORP.	FRENCHTOWN	NJ	
ARN	ARNOLD ENGINEERING CO.	MARENGO	IL	95566
ARMAT	AROMAT CORP.	ELK GROVE VILLAGE	IL	
ARW-M	ARROW-M CORP	CARSON	CA	
ASBAG	ASSOCIATED BAG CO.	MILWAUKEE	WI	
ASC	ASSOCIATED SPRING	BRISTOL	CT	92830
ASE	AIRCO SPEER ELECTRONICS	ST. MARYS	PA	06560
ASM	ACCURATE SCREW MACHINE CO	NUTLEY	NJ	51506
ASTID	ASTRO INDUSTRIES	DAYTON	OH	29365
AT/IN	ATLANTIC INDIA RUBBER CO	CHICAGO	IL	70485
ATC	AMERICAN TECHNICAL CERAMICS	HUNTINGTON STATN	NY	29990
ATR	ATR COIL CO.	BLOOMINGTON	IN	XXXXX
AUGAT	AUGAT, INC.	ATTLEBORO	MA	91506
AULT	AULT INC.	MINNEAPOLIS	MN	14310
AUTCP	AUTOMATION CORP.	PECKVILLE	PA	
AVDEL	AVDEL FASTENER SYS.	PARSIPPANY	NJ	19738
AVT	AVANTEK, INC.	SANTA CLARA	CA	24539
AWC	ALPHA WIRE	ELIZABETH	NJ	92194
B-T	BEK-TEK, INC.	READING	PA	XXXXX
B-W	BARKER & WILLIAMSON	BRISTOL	PA	05690

ABBR.	NAME.....	CITY.....	ST	FSCM.
BOKER	BOKER'S INC.	MINNEAPOLIS	MN	85446
BORIN	BORDEN INC.	COLUMBUS	OH	32283
BOU	BOURNS, INC.	RIVERSIDE	CA	80294
BRAUN	BRAUN MFG CO	CHICAGO	IL	93785
BREZ	BREEZE CORPORATIONS, INC.	UNION	NJ	08484
BSCAN	B-SCAN, INC.	PHILADELPHIA	PA	32198
BSHP	BISHOP GRAPHICS, INC.	WESTLAKE VILLAGE	CA	34730
BUCK	BUCKEYE STAMPING CO.	COLUMBUS	OH	21604
BUD	BUD RADIO, INC.	WILLOUGHBY	OH	71218
BURND	BURNDY CORP.	NORWALK	CT	09922
BUS	BUSSMAN MFG.	ST. LOUIS	MO	71400
BWC	BARON WIRE AND CABLE CORP.	CHICAGO	IL	72622
C-A	CIRCUIT ASSEMBLY CORP	COSTA MESA	CA	52072
C-D	CORNELL DUBILIER ELECT DIV	NEWARK	NJ	14655
C-E	CLINTON ELECTRONICS	ROCKFORD	IL	54972
C-H	CUTLER-HAMMER, INC.	MILWAUKEE	WI	55841
C-I	COMPONENTS, INC.	BIDDEFORD	ME	17554
C-J	TRW/CINCH	ELK GROVE VILLAGE	IL	71785
C-K	C & K COMPONENTS, INC.	WATERTOWN	MA	09353
C-L	CENTRALAB DIV.	MILWAUKEE	WI	71590
C-M	C-M			
C-W	C-W INDUSTRIES	WARMINSTER	PA	79727
CAE	CAPAR COMPONENTS CORP	MELVILLE	NY	
CAI	CUSTOM ACCESSORIES, INC.	SKOKIE	IL	XXXXX
CAM	CAMBION	CAMBRIDGE	MA	71279
CAR	CARLING ELECTRIC, INC.	WEST HARTFORD	CT	73559
CBLWV	CABLEWAVE SYSTEMS, INC.	NORTH HAVEN	CT	16733
CBRDM	CARBORUNDUM INSUL DIV	NIAGARA FALLS	NY	
CCM	CORCOM, INC.	LIBERTYVILLE	IL	05245
CDC	COMPONENT DEVELOPMENT CORP.	CARSON	CA	XXXXX
CECO	CENTRAL COIL CO.	BRAZIL	IN	XXXXX
CFI	CIRCUIT FUNCTIONS INC.	NEWBURY PK	CA	32499
CGW	CORNING GLASS WORKS	CORNING	NY	24546
CHE	CHERRY ELECTRICAL PRODUCTS	WAUKEGAN	IL	01963
CHEMP	CHEMPLAST,INC.	WAYNE	NJ	0
CHLAR	CHARLES LARSON CO.	STERLING	IL	
CHOM	CHOMERICS INC.	WOBURN	MA	18565
CHRY	CHRYSLER CORP.	DETROIT	MI	12204
CIMCO	CIMCO WIRE AND CABLE INC.	ALLENDALE	NJ	XXXXX
CINOX	CINOX CORP	CINCINNATI	OH	58997
CKI	CTS KNIGHTS, INC.	SANDWICH	IL	75378
CLA	CLAIREX CORP.	MT. VERNON	NY	03911
CLAR	CLAROSTAT MFG. CO	DOVER	NH	12697
CLCFT	COILCRAFT	CARY	IL	
CLFRM	COILFORM	GENEVA	IL	20254

ABBR.	NAME.....	CITY.....	ST	FSCM.
CLFX	COLE-FLEX CORP.	BABYLON	NY	56352
CLNRK	CALMARK CORP	SAN GABRIEL	CA	52094
CMLC	CAMLOC FASTENER	PARAMUS	NJ	
CNCRD	CONCORD ELEX	NEW YORK	NY	18310
CNTRN	CENTURION	*****	**	
COL	COLLNER SENICONDUCTORS INC	DALLAS	TX	
COORS	COORS PORCELAIN CO	GOLDEN	CO	
CPKG	CREATIVE PKG DIV	INDIANAPOLIS	IN	46203
CPLRD	CONPLETE-READING ELEC.CO.	DALLAS	TX	02358
CRDWL	CARDWELL CONDENSER CORP	LINDENHURST	NY	88356
CRMLY	CERNALLOY	WEST CONSHOHOCKEN	PA	
CRTR	CORE-TRONICS	ORANGE	NJ	29324
CSDC	CONDITIONING SEMICNDTR DVS	WAYNE	NJ	
CTC	COMMUNICATIONS XISTOR CORP	SAN CARLOS	CA	
CTS	CHICAGO TELEPHONE SYSTEMS	CHICAGO	IL	71450
CTS-E	CTS OF ELKHART	ELKHART	IN	71450
CTS-F	C.T.S. OF FAIRBERRY	FAIRBERRY	IL	71450
CTS-K	CTS OF KEENE	PASO ROBLES	CA	11237
CTSBR	CTS OF BERNE	BERNE	IN	11236
CTSBV	CTS OF BROWNSVILLE	BROWNSVILLE	TX	34263
CW/AL	C.W./ALPHA	SOUTHAMPTON	PA	
DAL	DALE TECHNOLOGY CORP.	HARTSDALE	NY	XXXXX
DATEL	DATEL SYSTENS, INC.	MANSFIELD	NA	50721
DAV	HARRY DAVIES MOLDING CO.	CHICAGO	IL	72512
DAYTN	DAYTON ELECTRIC CO.	CHICAGO	IL	16327
DEL	DELEVAN DIV.	EAST AURORA	NY	XXXXX
DEN	DENNISON NFG. CO.	FRANINGHAM	NA	16956
DEW	DEWIRE FABRICATING CORP.	LOWELL	NA	13161
DGTRN	DIGITRAN CO.	PASADENA	CA	
DILEC	DILECTRON	MONROVIA	CA	0
DIO	DIODES, INC.	CHATSWORTH	CA	12060
DIXON	DIXON INDUSTRIES INC.	BRISTOL	RI	04813
DK-WR	DAKO-WARE	CHICAGO	IL	
DLGHT	DIALIGHT	BROOKLYN	NY	72619
DLI	DIELECTRIC LABORATORIES INC	CAZENVIA	NY	55153
DLTEN	DELTA ELECTRONICS NFG CO	BEVERLY	MA	00795
DN-GY	DINCO-GRAY	CENTERVILLE	OH	80813
DNTCH	DONTECH, INC.			
DRA	DRAKE NANUFACTURING CO.	HARWOOD HEIGHTS	IL	71744
DRMYR	DORMEYER	ROCKVILLE	IN	73662
DUPNT	E.I.DUPONT DENENOURS & CO	WILMINGTON	DE	
DYNR	DYNEER CORP.	CHATSWORTH	CA	
E-C	ELECTRONIC CRYSTALS	KANSAS CITY	MO	18853
E-I	ELECTRICAL INDUSTRIES,INC.	MURRAY HILL	NJ	20093
E-M	ELECTRA/MIDLAND CORP.	MINERAL WELLS	TX	XXXXX
EATON	EATON CORP.	SUNNYVALE	CA	34657
EBY	EBY COMPANY	PHILADELPHIA	PA	72825
ECKDT	ECKARDT LABORATORIES	ORANGE	CA	
ECNC	ELECTRI-CORD MFG. CO. INC.	WESTFIELD	PA	XXXXX
EDAC	EDAC, INC.	DON MILLS, ONT., CANADA	**	31781
EECO	EECO, INC.	SANTA ANA	CA	97525

ABBR.	NAME.....	CITY.....	ST	FSCM.
ELC-I	ELECTRA	CUNBERLAND	IN	
ELCO	ELCO INDUSTRIES	ROCKFORD	IL	83486
ELDRE	ELDRE CONPONENTS, INC	ROCHESTER	NY	19648
ELEXP	ELECT EXPEDITERS	NILWAUKEE	WI	
ELFX	ELECTRO-FLEX HEAT INC.	BLOONFIELD	CT	02728
ELHIW	ELECTRONIC HARD	FARNINGDALE	NY	
ELNA	ELNA	CARSON	CA	
EM-CM	EMERSON & CUNING,INC	CANTON	NA	
EMRON			S	0
ENTHN	ENTHONE INC.	NEW HAVEN	CT	02259
EPITK	EPITEK ELECTRONICS	KANATA,ONT,CANADA	**	37907
EPOXT	EPOXY TECHNOLOGY, INC.	BILLERICA	MA	33246
ETC	ELECTRONIC TRANSISTOR CORP.	FLUSHING	NY	12045
ETP	ERIE TECHNOLOGICAL PRODUCTS	ERIE	PA	72982
EVRDY	EVEREADY	NEW YORK	NY	
EXAR	EXAR INTEGRATED SYSTEMS	SUNNYVALE	CA	52063
EZLOK	E-Z LOK	GARDENIA	CA	
F-K	THERMWELL PRODUCTS, INC.	FRANINGHAM	MA	XXXXX
F-S	FEDERAL SCREW	CHICAGO	IL	73734
FAN	FANCOURT & CO.	GREENSBORO	NC	XXXXX
FASTX	FASTEX DIV.,ILL.TOOL WORKS	DES PLAINES	IL	0
FCD	FAIRCHILD	MOUNTAIN VIEW	CA	07263
FCI	FILM CAPACITORS, INC.	PAS SALC	NJ	00686
FJTSU	FUJITSU ANERICA, INC.	LAKE BLUFF	IL	
FNWL	FENWAL	FRANINGHAM	MA	15801
FRDKS	FREDERICKS CO.	HUNTINGDON VALLEY	PA	
FRK	FRAKO	FRANKFORT, GER.	**	XXXXX
FRTE	FAIR RITE PRODUCTS CORP.	WALLKILL	NY	34899
FRXC	FERROXCUBE DIVISION	SAUGERTIES	NY	02114
FUT	FUTABA			
G-E	GENERAL ELECTRIC	INDIANAPOLIS	IN	24446
G-H	GRAYHILL, INC.	LA GRANGE	IL	81073
G-I	GEN'L INSTRUMENT SENICNDTR	HICKSVILLE	NY	14963
G-T	GRAND TRANSFORMERS	GRAND HAVEN	MI	02459
GAL	GALILEO ELECTRO-OPTICS	STURBRIDGE	MD	28719
GATES	GATES ENERGY PROD.	DENVER	CO	57053
GBN	GILBERT ENGINEERING CO.,INC	PHOENIX	AZ	82316
GCE	GC ELECTRONICS	ROCKFORD	IL	80112
GHZ	GHZ DEVICES, INC.	CHELNSFORD	MA	
GLOBE	GLOBE	NILWAUKEE	WI	
GNATR	GENERAL ATRONICS CORP.	PHILADELPHIA	PA	07407
GOU	GOULD, INC.	ST. PAUL	MN	55857
GRIES	GRIES REPRODUCER	NEW ROCHELLE	NY	05673
GRIP	GRIPMASTER CO.	MARLBORO	NJ	XXXXX
GRVCO	GROVE CONPANY	DAYTON	OH	
GUDL	GUDEBROD BROS. SILK CO.	CHICAGO	IL	XXXXX
GWNDA	GOWANDA ELEX CORP	GOWANDA	NY	
H-P	HEWLETT-PACKARD	INDIANAPOLIS	IN	28480
HARTW	HARTWELL CORP.	PLACENTIA	CA	0
HDMLD	DAVIES H MOLDING	CHICAGO	IL	
HEL	HELIPOT	ANAHEIM	CA	XXXXX

ABBR.	NAME.....	CITY.....	ST	FSCM.
HEY	HEYMAN MFG. CO.	WAUKESHA	WI	28520
HGHS	HUGHES SOLID-STATE PROD	NEWPORT BEACH	CA	
HHS	HERMAN H. SMITH, INC.	BROOKLYN	NY	03330
HI-G	HI-G INC	WINDSOR LOCKS	CT	02289
HIT	HITACHI AMERICA, LTD.	SAN FRANCISCO	CA	XXXXX
HMLN	HAMLIN	LAKE MILLS	WI	12617
HOLGW	HOLLINGSWORTH SLDRLS TERM.	POTTSTOWN	PA	14726
HOLUB	HOLUB DISTRIBUTING CO.	NEWPORT	KY	XXXXX
HSD	HARRIS CORP. SEMICDR. DIV.	MELBOURNE	FL	27410
HUD	HUDSON TOOL & DIE CO.	NEWARK	NJ	02875
HY/PL	HYDRO PLASTICS INC.	GEORGETOWN	KY	XXXXX
HYSOL	HYSOL CORP	INDUSTRY	CA	12405
HYSYS	HYBRID SYSTEMS	BEDFORD	MA	33256
HYT	HYTRONICS	PINELLAS PARK	FL	29525
IBNCO	INDIANA BOLT AND NUT CO.	INDIANAPOLIS	IN	
ICI	ILLINOIS CAPACITOR INC.	MORTON GROVE	IL	74840
ICO-R	ICO-RALLY	PALO ALTO	CA	
IDC	INTL DIODE CORP.	HARRISON	NJ	16068
IEE	INDUSTRIAL ELECTRONIC ENG	NORTH HOLLYWOOD	CA	05464
IERC	INT'L ELEC. RESEARCH CORP.	BURBANK	CA	98978
INDCP	INDUCTIVE COMPONENTS	HAUPPAUGE	NY	25159
INDEC	INDUSTRIAL ELECTRONIC HDWR.	NEW YORK	NY	97913
INDGL	INDIANA GENERAL	KEASBEY	NJ	72656
INLOK	INTERLOK/WM J PURDY CO.	BURLINGAME	CA	55951
INT	INTERSIL, INC.	CUPERTINO	CA	32293
INTEL	INTEL CORP	SANTA CLARA	CA	34649
INWEB	INTERNATIONAL WEBBING	WHITEHALL	PA	32860
IRC	INTERNATIONAL RESISTANCE CO	PHILADELPHIA	PA	75042
IREC	INT'L RECTIFIER CORP.	LOS ANGELES	CA	81483
ISTMP	ISOTEMP RESEARCH, INC.	CHARLOTTESVILLE	VA	31785
ITRON	ISE ELECTRONICS	ISE,JAPAN	**	0
ITT	INT'L TELEPHONE & TELEGRAPH	W. PALM BEACH	FL	XXXXX
JAMES	JAMES ELECTRONICS	CHICAGO	IL	12749
JAN	JAN HARDWARE MFG. CO.	LONG ISLAND CITY	NY	99813
JEF	JEFFERS	DUBOIS	PA	97469
JEFWC	JEFFERSON WIRE AND CABLE	WORCHESTER	MA	07883
JEW	JEWELL ELECTRICL INST	MANCHESTER	NH	
JFD	JFD ELECTRONICS	BROOKLYN	NY	73899
JFW	JFW INDUSTRIES	BEECH GROVE	IN	56532
JHSN	JOHANSON MFG. CORP.	BOONTON	NJ	91293
JON	E.F. JOHNSON CO.	WASECA	MN	74970
JUDD	JUDD WIRE DIV. ECC	TURNERS FALLS	MA	12703
K-L	KERRIGAN LEWIS MFG.	CHICAGO	IL	73920
K-S	K & S ENGINEERING CO.	CHICAGO	IL	22376
KDI-P	KDI-PYROFILM CORP.	WHIPPANY	NJ	03888
KEENE	KEENE CORP.	NEWARK	DE	52869
KEM	KEMTRON ELECTRON PRODUCTS	NEWBURYPORT	MA	92703
KEY	KEYSTONE ELECTRONIC CORP.	NEW YORK	NY	91833
KID	KIDCO, INC.	MEDFORD	NJ	12126

ABBR.	NAME.....	CITY.....	ST	FSCM.
KIN	KINGS ELECTRONICS	TUCKAHOE	NY	91833
KMYO	KAMAYA OHM	JAPAN	**	
KRYST	KRYSTINEL	PATERSON	NJ	29251
KSTR	KESTER SOLDER DIV.	CHICAGO	IL	09185
KSW	KSW ELECTRONICS	BURLINGTON	MA	52673
KUL	KULKA ELECTRIC CORP.	MT. VERNON	NY	75382
KYCRA	KYOCERA INTERNATIONAL	SAN DIEGO	CA	
LAMB	LAMB INDUSTRIES, INC.	PORTLAND	OR	
LAURN	LAUREN MFG CO.	NEW PHILADELPHIA	OH	56329
LEYSE	LEYSE ALUMINUM CO.	KEWANEE	WI	20218
LIT	LITTELFUSE, INC.	DES PLAINES	IL	75915
LNMST	LINEMASTER SWITCH CORP.	WOODSTOCK	CT	97918
LOCTT	LOCTITE CORP.	NEWINGTON	CT	05972
LRC	LRC ELECTRONICS, INC.	HORNELL	NY	16157
LSI	LUMINESCENT SYSTEMS, INC	LEBANON	NH	16157
LTRNX	LITRONIX	CUPERTINO	CA	50579
M-A	MICROWAVE ASSOCIATES	BURLINGTON	MA	96341
M-D	MILLER DIAL & NAMEPLATE CO.	EL MONTE	CA	74072
M-E	MEPCO ELECTRA, INC.	MORRISTOWN	NJ	19701
M-O	ILLUMINATED PRODUCTS INC.	SANTA ANA	CA	XXXXX
M-P	MICRO PLASTICS INC.	CHATSWORTH	CA	31223
MAL	MALLORY CONTROLS CO.	FRANKFORT	IN	90201
MAND	MANDEX	CHICAGO	IL	98278
MARQ	J. & J. MARQUARDT	TUTTLINGEN, GER.	**	XXXXX
MCMTL	MICROMETALS, INC	ANAHEIM	CA	12856
MCREL	MICRO ELEX LTD	HONG KONG	**	
MD-AM	MID AMERICA	CHICAGO	IL	
MDC	MAIDA DEVELOPMENT CO.	HAMPTON	VA	91984
MDLRS	MIDLAND ROSS	CINCINNATI	OH	57951
MDTC	MODUTEC	NORWALK	CT	32171
MFLCO	MAURICE FRANKLIN LOUVER CO.	PROVIDENCE	RI	
MILN	MILLEN MFG. CO.	NEW YORK	NY	XXXXX
MILSP	MILITARY SPECIFICATION	WASHINGTON	DC	81349
MIN-C	MINI-CIRCUITS	BROOKLYN	NY	15542
MINIS	MINI SYSTEMS	NORTH ATTLEBORO	MA	50316
MINOR	MINOR RUBBER CO.	BLOOMFIELD	NJ	76385
MITEK	MITEK	LEXINGTON	MA	0
MLRJW	J.W. MILLER	COMPTON	CA	96804
MMM	3M COMPANY	ST. PAUL	MN	
MNO	MONSANTO COMM. PROD. DIV.	PALO ALTO	CA	50522
MOL	MOLEX PRODUCTS	LISLE	IL	27264
MORAD	MORGAN ADHESIVES	STOW	OH	17452
MOSTK	MOSTK CORP.	CARROLLTON	TX	50088
MOT	MOTOROLA SEMI. PROD. DIV.	INDIANAPOLIS	IN	04713
MOUS	MOUSER ELECTRONICS	LAKESIDE	CA	50811
MRM	M. ROSS MASON	INDIANAPOLIS	IN	
MRO	MICRO SWITCH DIV.	FREEPORT	IL	91929
MRRUB	MARION RUBBER PROD.	INDIANAPOLIS	IN	
MSN	MICROSONICS DIV.	WEYMOUTH	MA	11869
MSP	MICRO SEMICONDUCTOR CORP.	SANTA ANA	CA	14552

ABBR.	NAME.....	CITY.....	ST	FSCM.
MULSO	MULTICORE SOLDERS LTD.	WESTBURY	NY	03051
MURA	MURA	WESTBURY	NY	32539
MURGA	MURATA-GEORGIA	MARIETTA	GA	51406
MWS	MAGNET WIRE SUPPLY CO.	CHATSWORTH	CA	51668
MWS-P	MWS PRECISION WIRE INDUS	WESTLAKE VILLAGE	CA	
MYERS	MYERS SPRING CO.	LOGANSPORT	IN	91956
N-T	NATIONAL TEL-TRONICS	LAREDO	TX	XXXXX
NAT	NATIONAL SEMICONDUCTOR CORP	SANTA CLARA	CA	27014
NCC	NATIONAL CERAMIC CO	TRENTON	NJ	76626
NCSVC	NATL COM SERV.	WILLOW GROVE	PA	
NEC	NIPPON ELECTRIC CO.	TOKYO, JAPAN	**	18324
NEL	NATIONAL ENGINEERING LABS	INDIANAPOLIS	IN	XXXXX
NEMCO	NEMCO METALS, INC	MANVILLE	RI	
NEW	NEWARK ELECTRONICS	INDIANAPOLIS	IN	XXXXX
NHWC	NEW HAVEN WIRE & CABLE	NEW HAVEN	IN	XXXXX
NICHN	NICHICON (AMERICA) CORP.	SCHAUMBURG	IL	55680
NMB	NMB CORP.	ARLINGTON HEIGHTS	IL	60005
NMC	MAGNUM MICROWAVE CORP.	SUNNYVALE	CA	59277
NPC	NUCLEONIC PRODUCTS CO.	CANOGA PARK	CA	0
NRTLK	NORTHLAKE ENG, INC	ANTIOCH	IL	50638
NYLO	NYLOMATIC	MORRISVILLE	PA	XXXXX
O-G	OPTI-GAGE INC.	DAYTON	OH	XXXXX
O-S	OMNI SPECTRA INC.	FARMINGTON	MI	16179
OAK	OAK INDUSTRIES INC.	CRYSTAL LAKE	IL	76854
OHM	OHMITE MFG. CO.	SKOKIE	IL	44655
OMEGA	OMEGA WIRE & CABLE	HARLEYSVILLE	PA	XXXXX
OPTO	OPTO ELECTRONICS INC	FT LAUDERDALE	FL	
OPTRN	OPTRON INC.	CARROLLTON	TX	XXXXX
P-B	POTTER AND BRUMFIELD	PRINCETON	IN	77342
P-C	POWER COMPONENTS	WOODLAND HILLS	CA	XXXXX
P-K	PARKER KALON CORP.	CLIFTON	NJ	XXXXX
P-T	PENN TUBE PLASTICS CO.	CLIFTON HEIGHTS	PA	0
P-U	PROJECTS UNLIMITED INC.	DAYTON	OH	XXXXX
POLPH	POLYPHASE INSTR. CO.	BRIDGEPORT	PA	0
PACTC	PACTEC DIV.	PHILADELPHIA	PA	
PAM	PAMOTOR DIV.	BURLINGAME	CA	23936
PAND	PANDUIT CORP.	TINLEY PARK	IL	06383
PARA	PARAMETRIC INDUSTRIES	NORTHFIELD	IL	XXXXX
PCC	PANEL COMPONENTS CORP.	BERKELEY	CA	00000
PEC	PACIFIC ELECTRICORD CO.	GARDENA	CA	80126
PEM	PENN ENGRG & MANUF CO.	DANBORO	PA	
PFZR	PFIZER,INC,	NEW YORK	NY	86491
PHC	PHILADELPHIA HANDLE CO.	CAMDEN	NJ	XXXXX
PHILP	PHILPOTT RUBBER CO.	CLEVELAND	OH	86510
PIC	PIHER INTERNATIONAL CORP.	ARLINGTON HEIGHTS	IL	54869
PIEZO	PIEZO TECHNOLOGIES, INC.	ORLANDO	FL	
PLI	PRECISION LAMP, INC.	MT. VIEW	CA	48451
PLSSY	PLESSEY ENG.	SCHILLER PARK	IL	55112
PLSTI	PLASTIC TECHNIQUES, INC	NEW BOSTON	NH	
PLYCL	POLYCLAD LAMINATES	SOUTHFIELD	MI	
PMCL	PERMACEL DIV.	NEW BRUNSWICK	NJ	99742

ABBR.	NAME.....	CITY.....	ST	FSCM.
PMI	PRECISION MONOLITHICS INC.	SANTA CLARA	CA	06665
PNSNC	PANASONIC			
POLPH	POLYPHASE INSTR,CO	BRIDGEPORT	PA	98330
POM	POMONA ELECTRONICS CO.,INC	POMONA	CA	05276
PREH	PREH VERT,MBH	GERMANY	**	
PRMD	PYRAMID INDUSTRIES, INC.	PHOENIX	AZ	XXXXX
PRRES	PRECISION RESISTIVE PRDTS	MEDIAPOLIS	IA	
PRSLK	PRESTO-LOCK	GARFIELD	NJ	77386
PRSN	PRECISION TUBE CO., INC	NORTH WALES	PA	82413
PTN	PENN TRAN CORP.	BELLEFONT	PA	XXXXX
PWRMT	POWER-MATE CORP.	HACKENSACK	NJ	
PYRO	PYROFILM CORP.	WHIPPANY	NY	XXXXX
PYTT	PYTTRONICS INDUSTRIES, INC.	MONTGOMERYVILLE	PA	31924
Q-C	QUALITY COMPONENTS	ST. MARYS	PA	95121
R-E	ROBISON ELECTRONICS	SAN LUIS OBISPO	CA	
R-N	ROBINSON-NUGENT	NEW ALBANY	IN	0
R-OHM	R-OHM	IRVINE	CA	57668
RAF	RAF ELECTRONIC HDWE	STRAFFORD	CT	
RAWST	RAW STOCK	*****	**	
RAY	RAYTHEON	INDIANAPOLIS	IN	49956
RAYVC	RAY-O-VAC/DV	MADISON	WI	
RBRCT	RUBBERCRAFT	*****	**	
RCA	RCA	CAMDEN	NJ	02735
RCHLK	RICHLOK CORP	CHICAGO	IL	
REL	RELIANCE MICA CO.	BROOKLYN	NY	08530
RGNCY	REGENCY ELECTRONICS, INC.	INDIANAPOLIS	IN	
RGR	ROGERS CORP.	CHANDLER	AZ	31745
RICH	RICHCO PLASTIC CO.	CHICAGO	IL	06915
RICHM	RICHARDS METAL PRODUCTS	WOLCOTT	CT	19076
RMC	RADIO MATERIALS CORP.	CHICAGO	IL	82560
RMF	RMF PRODUCTS INC.	BATAVIA	IL	XXXXX
ROCKW	ROCKWELL INTL.	ANAHEIM	CA	33085
ROGAN	ROGAN CORP.	NORTHBROOK	IL	86797
ROTRN	ROTRON INC.	WOODSTOCK	NY	82877
RPBLC	REPUBLIC ELECTRONICS CORP	PATTERSON	NJ	
RSSLL	RUSSELL	OCEANSIDE	NY	24324
RTNA	ROSENTHAL TECHNIK,N.A.	PROVIDENCE	RI	
S-C	SPECIALTY CONNECTOR	INDIANAPOLIS	IN	24931
S-G	STANDARD GRIGSBY	AURORA	IL	82104
S-I	SWITCHCRAFT, INC.	CHICAGO	IL	82389
S-S	SERVICE SUPPLY	INDIANAPOLIS	IN	XXXXX
S-T	SARKES TARZIAN	BLOOMINGTON	IN	51589
SAE	STANFORD APPLIED ENG	SANTA CLARA	CA	
SAGE	SAGE LABORATORIES, INC.	NATIC	MA	
SAYRO	SAYROSA ENGINEERS LTD.	ALTON, HANTS, U.K	**	04180
SCBE	SCANBE DIVISION	EL MONTE	CA	18677
SCC	STACKPOLE CARBON CO.	ST. MARYS	PA	78488
SCX	SILICONIX INC.	SANTA CLARA	CA	17856
SEAST	SEASTROM MFG. CO.	GLENDALE	CA	86928
SECR	SECOR INC.	WESTWOOD	NJ	0

ABBR.	NAME.....	CITY.....	ST	FSCM.
TFI	T&F INDUSTRIES DIV.	ROLLING MEADOWS	IL	58933
THR	THERMALLOY CO.	DALLAS	TX	13103
TIMES	TIMES WIRE AND CABLE	CINCINNAI	OH	XXXXX
TIN	TINNERMAN PRODUCTS, INC.	CLEVELAND	OH	78553
TKN	TECHNICAL WIRE	CRAWFORD	NJ	XXXXX
TLNC	TELONIC ALTAIR	LAGUNA BEACH	CA	04423
TLSBY	TILSBY	*****	**	
TOKO	TOKO AMERICA	SKOKIE	IL	
TORCO	TOR CORP.	VAN NUYS	CA	XXXXX
TR-UT	TRIAD-UTRAD DIV.	HUNTINGTON	IN	0
TRIYX	TRIONYX INDUSTRIES	INDIANAPOLIS	IN	
TRNSN	TRANSENE CO., INC.	ROWLEY	MA	53796
TRU	WALDES TRUARC	LONG ISLAND CITY	NY	79136
TRW	TRW CAPACITOR DIV.	OGALLALA	NB	84411
TSHBA	TOSHIBA AMERICA INC	WAYNE	NJ	00000
TUSNX	TUSONIX, INC.	TUCSON	AZ	59660
TVL	TEL-VISION LABS	WAUCONDA	IL	0
TWAY	TWAY COMPANY	INDIANAPOLIS	IN	0
TYTON	TYTON CORP.	MILWAUKEE	WI	
U-C	UNIVERSAL COMPONENTS	LOS ANGELES	CA	82933
ULSP	UNDERWRITERS LAB. SPEC.	CHICAGO	IL	0
UNCAR	UNION CARBIDE COMPONENTS	GREENVILLE	SC	57185
UNCHM	UNITED CHEMI-CON			
UNIC	UNICORP	ORANGE	NJ	04729
UNIT	UNITRODE CORP.	WATERTOWN	MA	12969
USECO	USECO DIV.	VAN NUYS	CA	88245
UTK	UNITRACK DIV.	UPPER DARBY	PA	XXXXX
VAC	VACTEC INC.	MARYLAND HEIGHTS	MO	18178
VACO	VACO PRODUCTS CO.	NORTHBROOK	IL	79061
VAR	VARADYNE CAPACITOR DIV.	SANTA MONICA	CA	26654
VARIL	VARI-L CO.	DENVER	CO	05375
VARO	VARO SEMICONDUCTOR INC	GARLAND	TX	
VCTRN	VECTRON LABORATORIES,INC.	NORWALK	CT	27802
VELCR	VELCRO USA INC	NEW YORK	NY	11153
VIC	VICTOREEN INC	CLEVELAND	OH	
VISCM	VISUAL COMM	PLAYA DEL REY	CA	56769
VLIER	VLIER ENGINEERING CORP.	BURBANK	CA	01226
VLTRX	VOLTREX	*****	**	
VONGT	VONNEGUT HARDWARE	INDIANAPOLIS	IN	XXXXX
VRN	VERNITRON CORP.	GREAT NECK	NY	XXXXX
VSSNC	VIEWSONICS, INC.	SYOSSET	NY	59108
VTRMN	VITRAMON, INC.	BRIDGEPORT	CT	95275
W-E	WELLS ELECTRONICS	SOUTH BEND	IN	14329
W-I	WAVETEK INDIANA, INC.	BEECH GROVE	IN	34280
WAG	WAGNER ELECTRIC CORP.	ST. LOUIS	MO	63477
WBSH	WABASH RELAY & ELECT.	WABASH	IN	18542
WECK	WECKESSER CO., INC.	CHICAGO	IL	95987
WHBRY	W.H.BRADY INDL PRDS DIV	MILWAUKEE	WI	
WHTMN	WHITMAN	CINCINNATI	OH	
WKFLD	WAKEFIELD ENGINEERING	WAKEFIELD	MA	05820
WLDM	WALDOM	CHICAGO	IL	92219
WMBG	W.M. BERG	ROCKAWAY	NY	
WNSL	WEINSCHEL ENGINEERING	GAITHERSBURG	MD	93459

ABBR.	NAME.....	CITY.....	ST	FSCM.
SEL	SEALECTRO CORP.	MAMARONECK	NY	98291
SEM	SEMTECH	NEWBURY PARK	CA	14099
SEMTX	SEMTEX	DAYTON	OH	0
SENST	SENSOTEC INC	COLUMBUS	OH	51518
SGM	SIGMA INSTRUMENTS	BRAINTREE	MA	72421
SGS-A	SGS-ATES COMP ELET SPA	AGRATE BRIANZE, ITALY	**	
SHAM	SHAMROCK PLASTICS & RUBBER	INDIANAPOLIS	IN	XXXXX
SHDW	I.E.E. SCHADOW	EDEN PRAIRIE	MN	
SHKMN	SHACKMAN INSTRUMENTS	CHESHAM, ENGLAND	**	0
SHURE	SHURE BROS, INC.	EVANSTON	IL	
SIEM	SIEMENS	ISELIN	NJ	25088
SIG	SIGNETICS CORPORATION	SUNNYVALE	CA	18324
SIGPT	SIGMA PLASTRONICS	DEARBORN	MI	
SINCR	SINCLAIR & RUSH, INC.	ST. LOUIS	MO	15819
SKDRV	STOCK DRIVE PROD. DIV.	NEW HYDE PARK	NY	
SLCGN	SILICON GENERAL INC	GARDEN GROVE	CA	34333
SLT	SOLITRON/MICROWAVE DIV.	PORT SALERNO	FL	95077
SMTC	SANTEC INC.	NEW ALBANY	IN	55322
SNSTK	SENSOR TECHNOLOGY CO	SEATTLE	WA	
SOART	STATE OF THE ART, INC	STATE COLLEGE	PA	56235
SOURU	SOURIAU	VAN NUYS	CA	
SOUTH	SOUTHCO FASTENERS	LESTER	PA	94222
SPE	SPECTROL	DAYTON	OH	02111
SPEC	SPECTRUM CONTROL, INC.	FAIRVIEW	PA	33095
SPPRD	SPECIALTY PRODUCTS	INDIANAPOLIS	IN	
SPR	SPRAGUE ELECTRIC CO.	INDIANAPOLIS	IN	56289
SPRTX	SUPERTEX INC.	CUPERTINO	CA	0
SPST	SPECTRA-STRIP	GARDEN GROVE	CA	08261
SPY	SPYRAFLO INC	PEACHTREE CITY	GA	
SSS	SOLID STATE SCIENTIFIC	MONTGOMERYVILLE	PA	31019
STC	SILICON TRANSISTOR CORP	CHELMSFORD	MA	
STDPS	STANDARD PRESSED STEEL	JENKINTOWN	PA	03680
STI	SEMICNDTR TECHNOLOGY INC	STUART	FL	
STKFS	STAKE FASTENERS	SOUTH EL MONTE	CA	
STR	STETTNER TRUSH CO.	CAZENOVIA	NY	52763
STSA	STEEL SALES	INDIANAPOLIS	IN	XXXXX
SULL	SULLINS ELECTRONICS CORP	SAN MARCOS	CA	
SXNBG	SAXONBURG CERAMICS	SAXONBURG	PA	
SYL	GTE SYLVANIA	WALTHAM	MA	94131
SYN	SYNTRONIC INSTRUMENTS	ADDISON	IL	99409
SYNTC	SYNTAC CORP.	CLEVELAND	OH	
SYNTK	SYNERTEK	**	*	
SYS	SYSCON INTERNATIONAL, INC.	SOUTH BEND	IN	32436
T-B	THOMAS & BETTS	RARITAN	NJ	59730
T-I	TEXAS INSTRUMENTS	DALLAS	TX	01295
TAPP	TAPE PRODUCTS, INC	*****	**	
TCPL	TACONIC PLASTIC	PETERSBURG	NY	59688
TEK	TEKTRONIX	INDIANAPOLIS	IN	80009
TEKA	TEKA PRODUCTS INC.	COLLEGE POINT	NY	58050
TEKNT	TECKNIT	CRANFORD	NJ	
TELE	TELETYPE CORP.	ELK GROVE VILLAGE	IL	XXXXX
TELRY	TELEDYNE RELAYS	HAWTHORNE	CA	11532

ABBR.	NAME.....	CITY.....	ST	FSCM.
WNZLR	WINZLER MFG	CHICAGO	IL	09109
WRC	WIRE RESEARCH CORP	SANTA ANA	CA	
WSD	WAVETEK	SAN DIEGO	CA	23338
WSTN	WESTON COMPONENTS	ARCHBALD	PA	94075
ZEN	ZENITH RADIO CORP.	CHICAGO	IL	67177
ZERO	ZERO MANUFACTURING CO.	BURBANK	CA	98376
ZIE	ZIERICK MFG. CORP.	MOUNT KISCO	NY	79963
ZPT	ZIPPERTUBING, CO.	LOS ANGELES	CA	07240

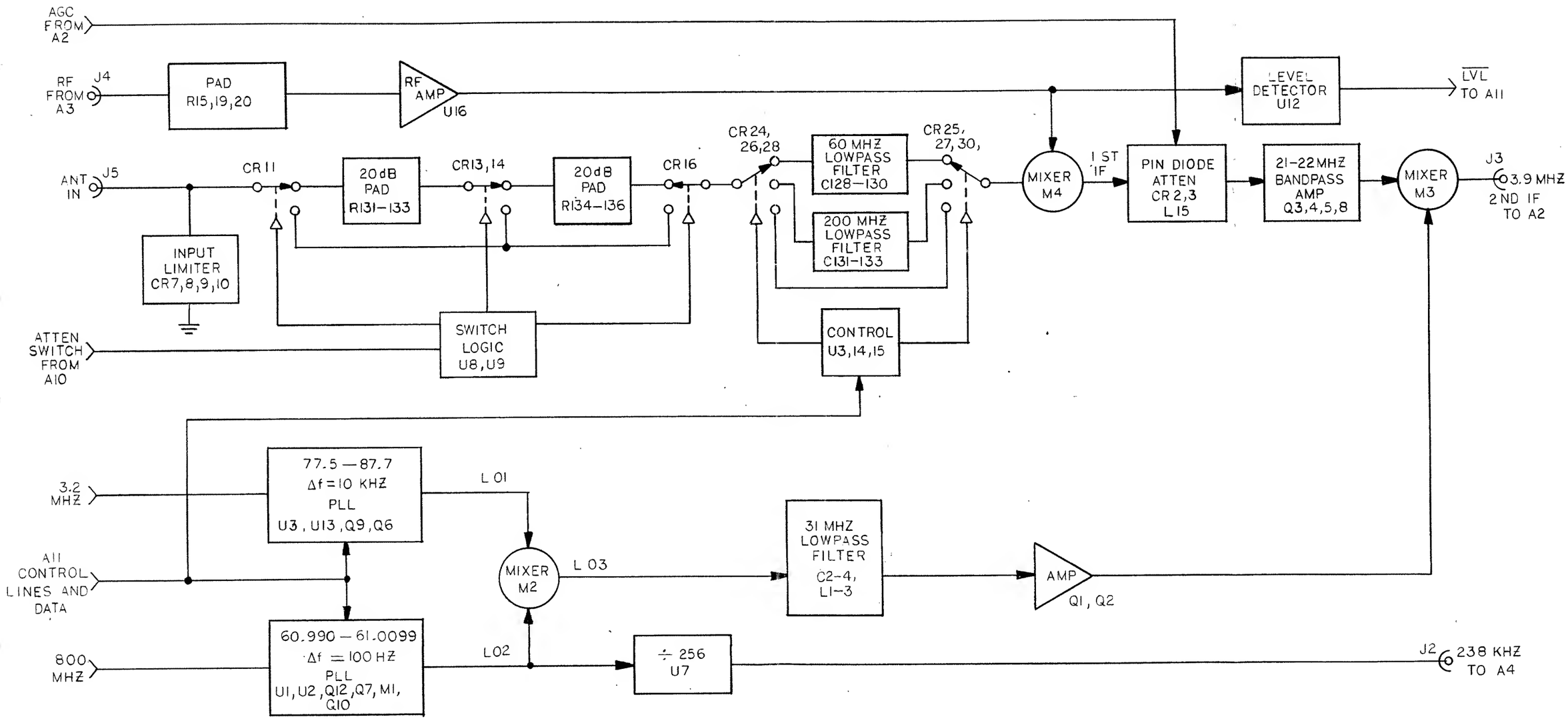
SECTION 8

SCHEMATICS & COMPONENT BOARD ASSEMBLIES

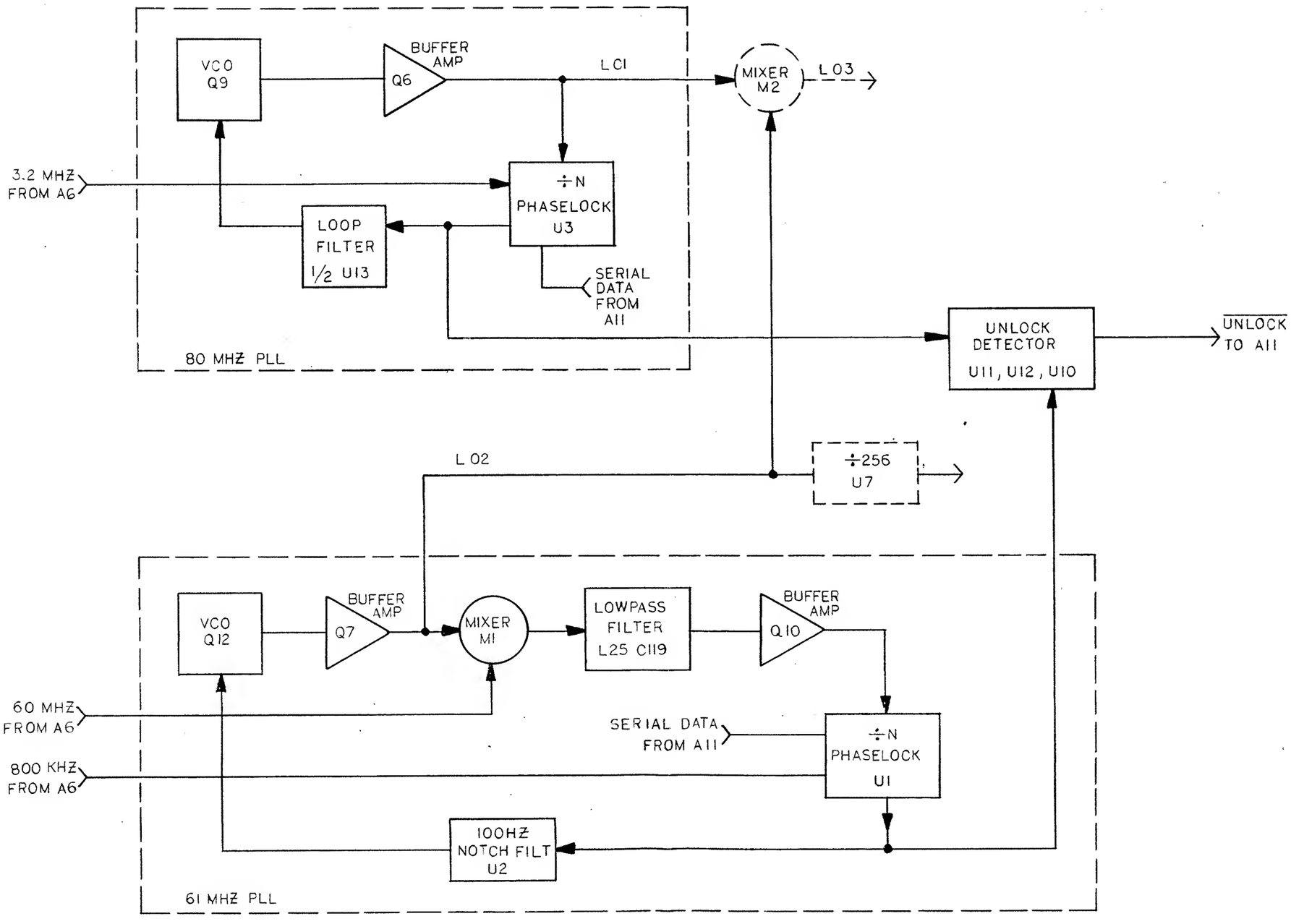
The Schematics appear in the following order:

Cable Interconnection Diagram
Front Panel Wiring
Rear Panel Wiring
A1 Receiver Board
A2 IF Amplifier Board
A3 Synthesizer Board
A4 Generator Board
A5 Audio Board
A6 Low Voltage P.S. Board
A7 Deflection Board
A8 High Voltage P.S. Board
A9 LCD Board
A10 Front Panel Board
A11 Processor Board
A12 Inverter Board
A13 Mother Board

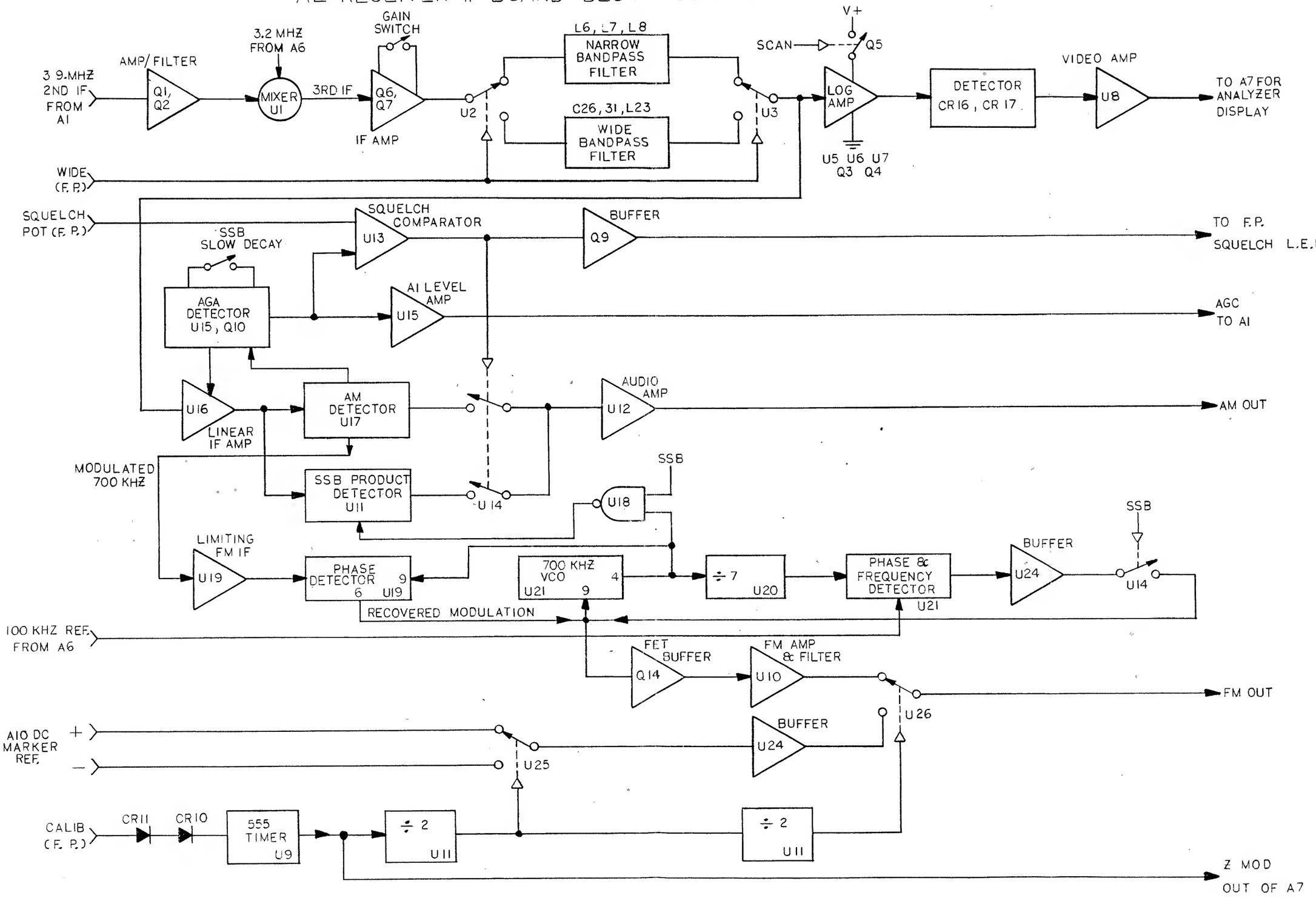
A1 RECEIVER BOARD BLOCK DIAGRAM



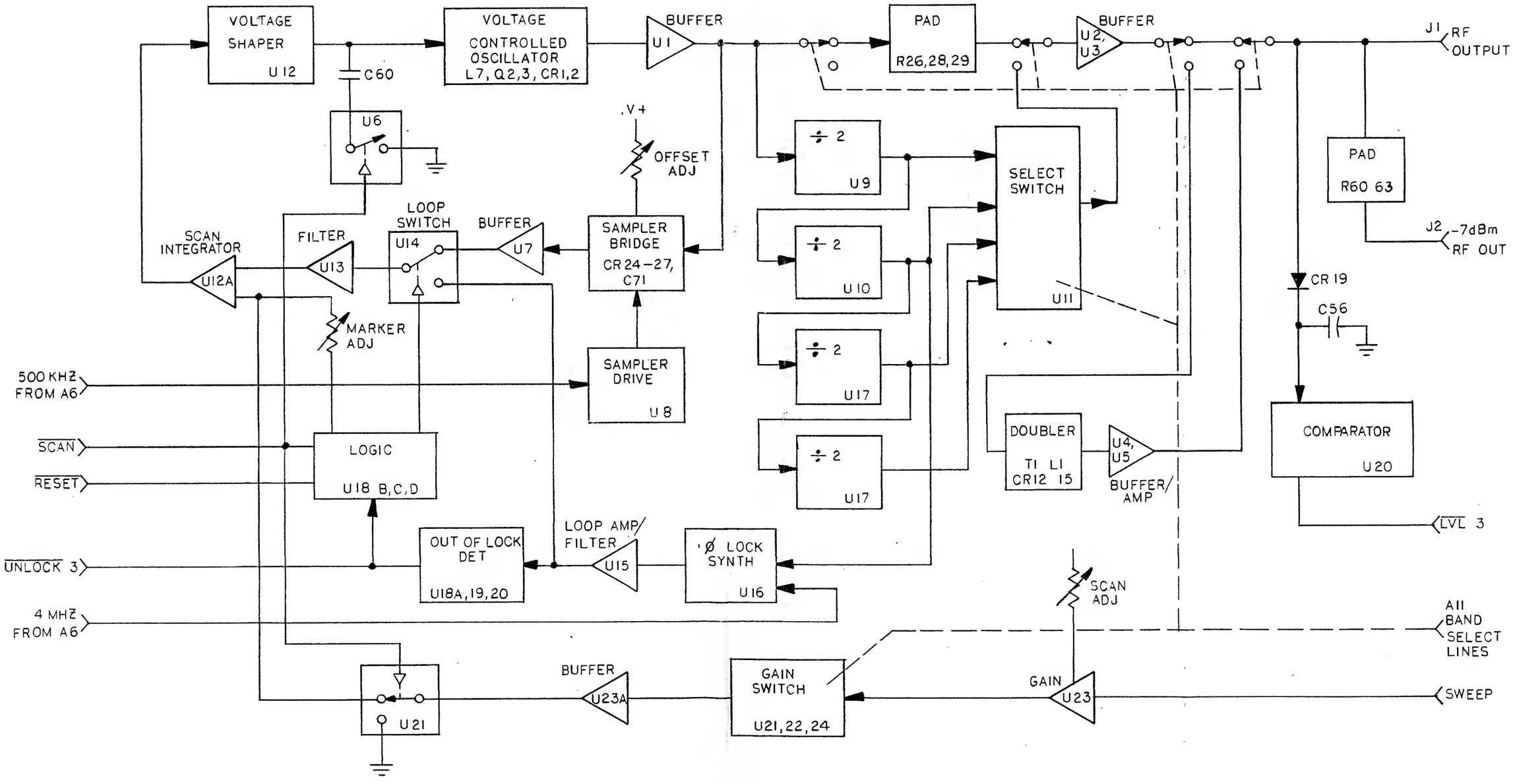
A1 PHASE LOCKED LOOPS BLOCK DIAGRAM



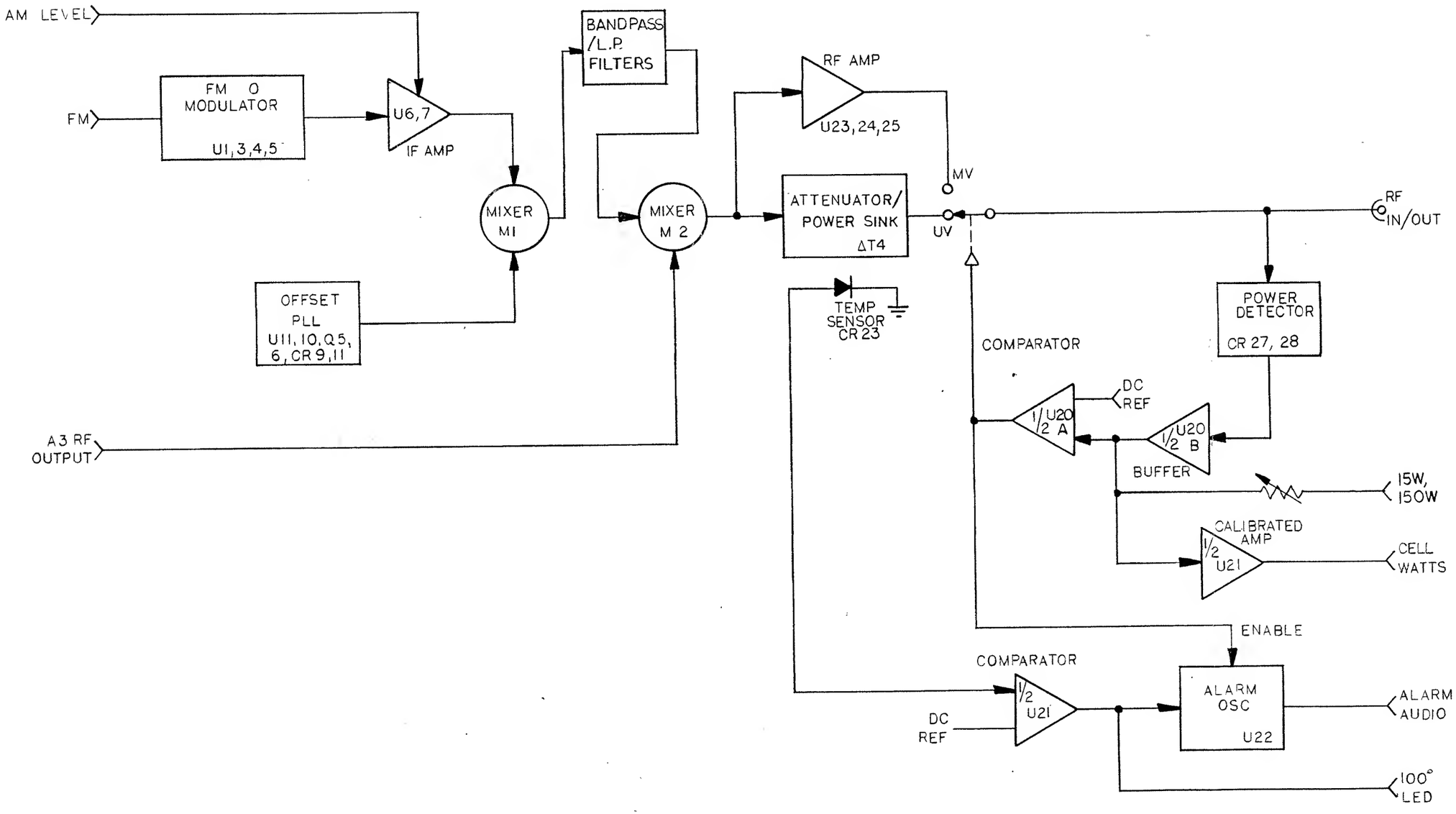
A2 RECEIVER IF BOARD BLOCK DIAGRAM



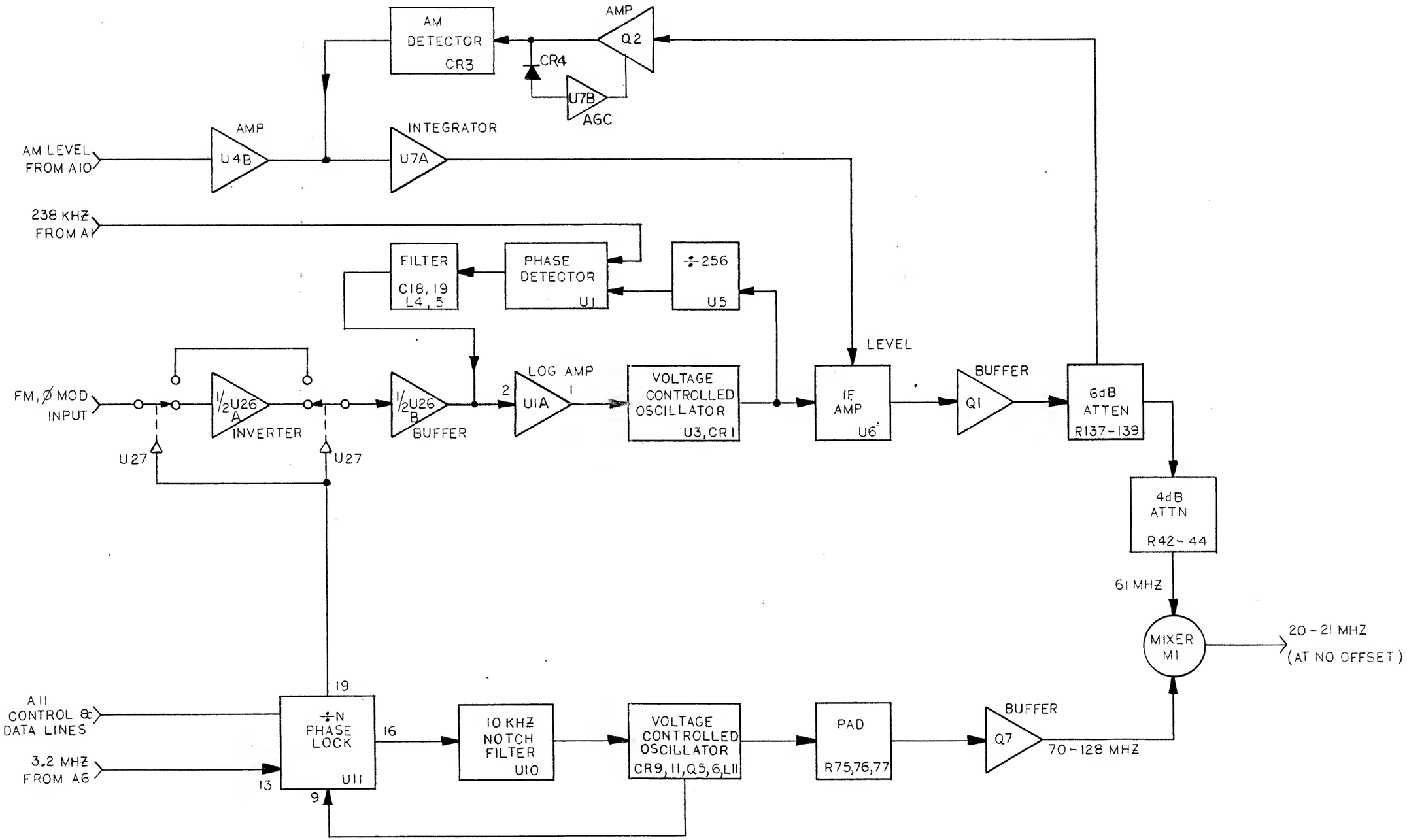
A3 HIGH FREQUENCY SYNTHESIZER BLOCK DIAGRAM



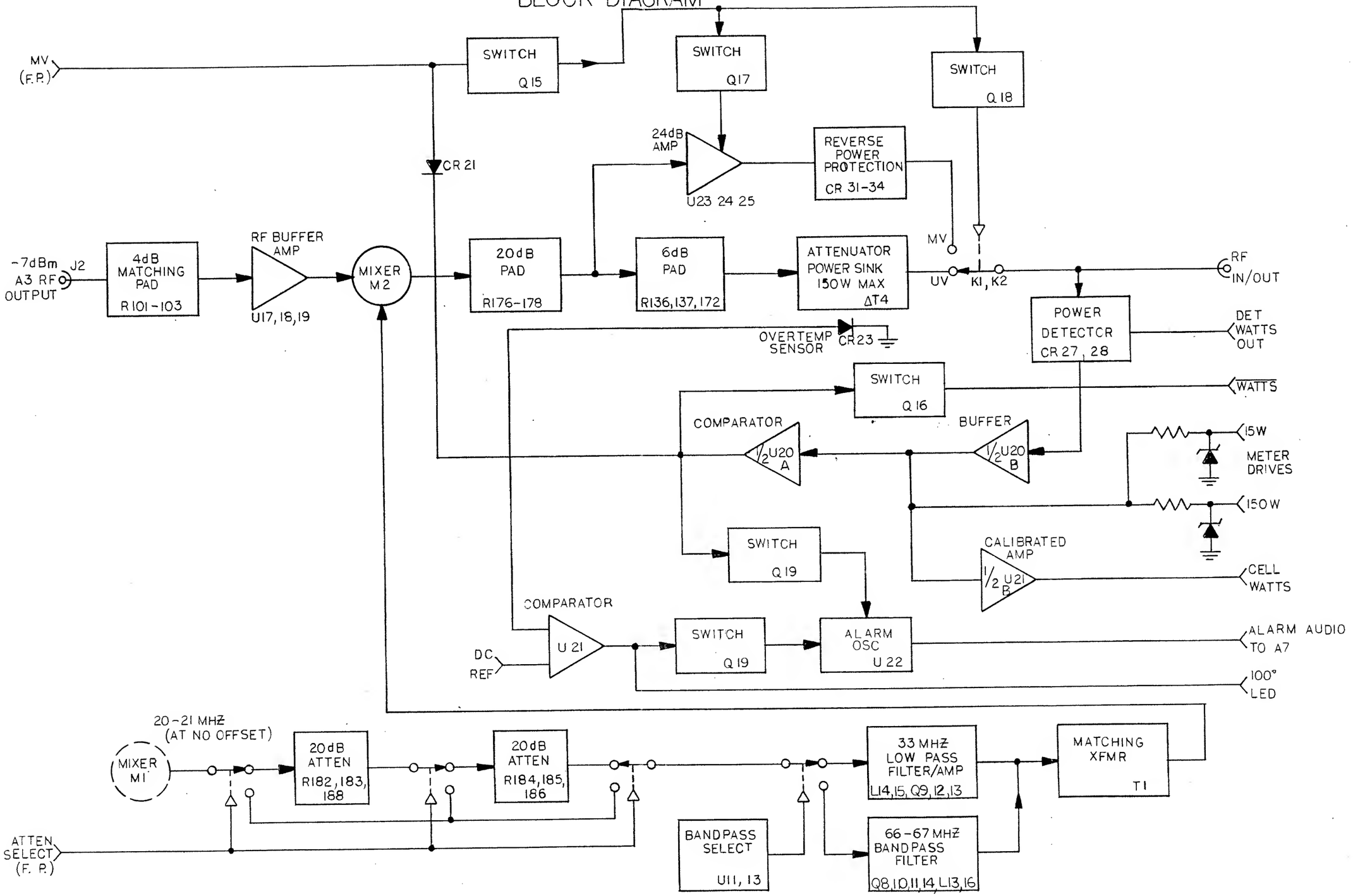
A4 GENERATOR BOARD
SIMPLIFIED BLOCK DIAGRAM



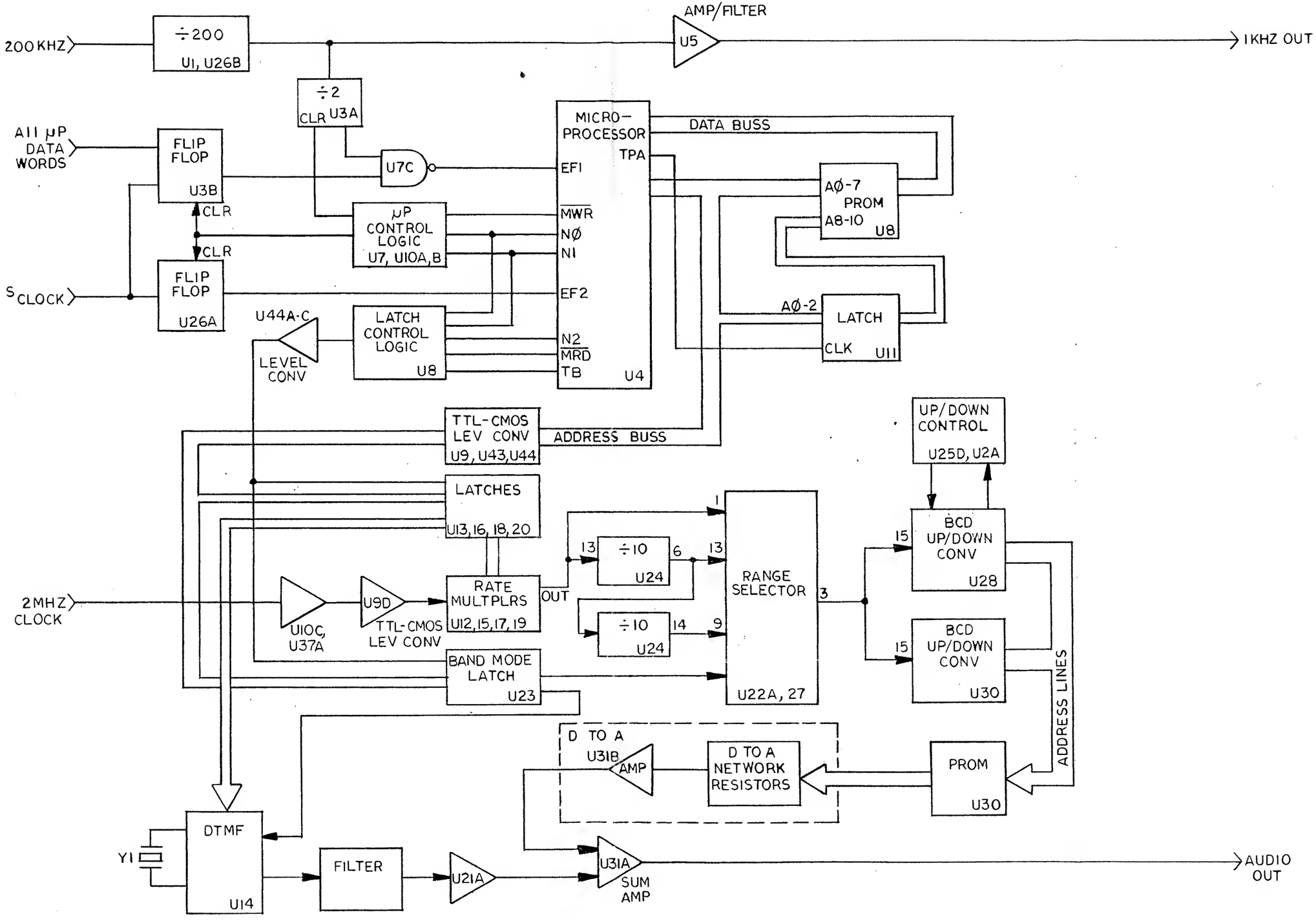
A4 GENERATOR BOARD
IF MODULATION AND OFFSET CIRCUITS
BLOCK DIAGRAM



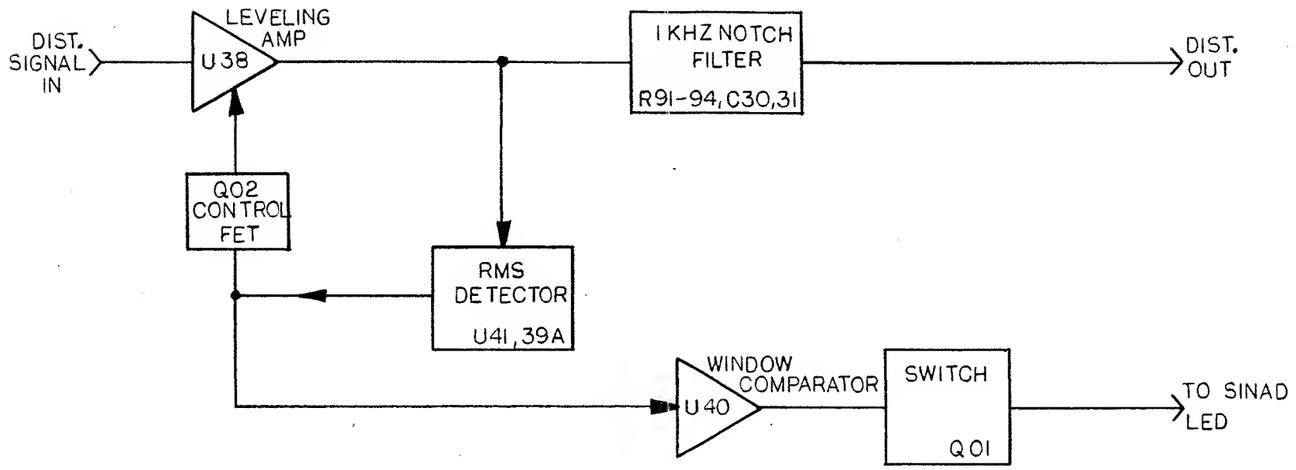
A4 GENERATOR BOARD
RF GENERATOR POWER DETECTION ALARM CIRCUITS
BLOCK DIAGRAM



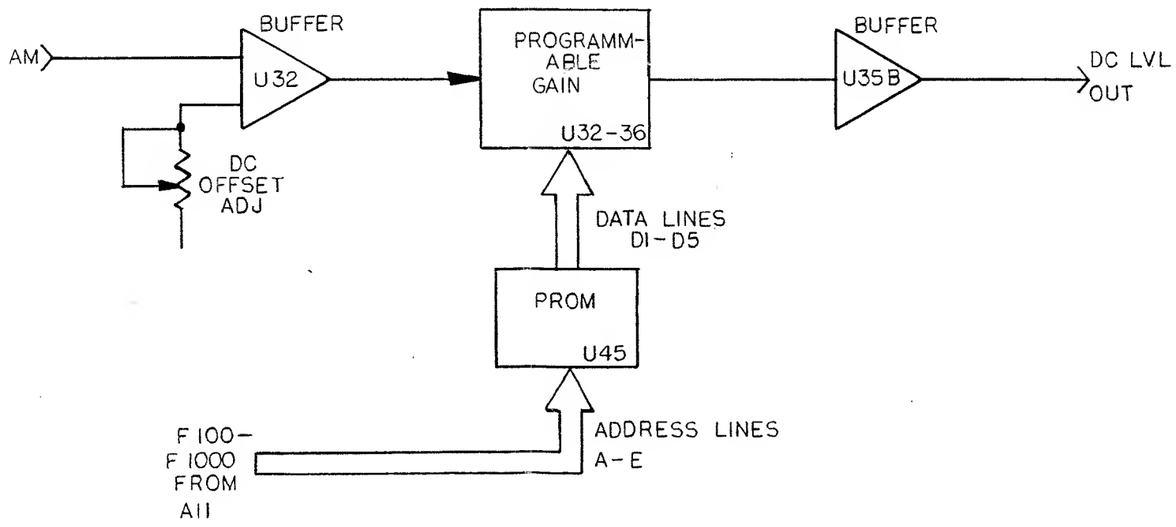
A5 AUDIO SYNTHESIZER BOARD BLOCK DIAGRAM



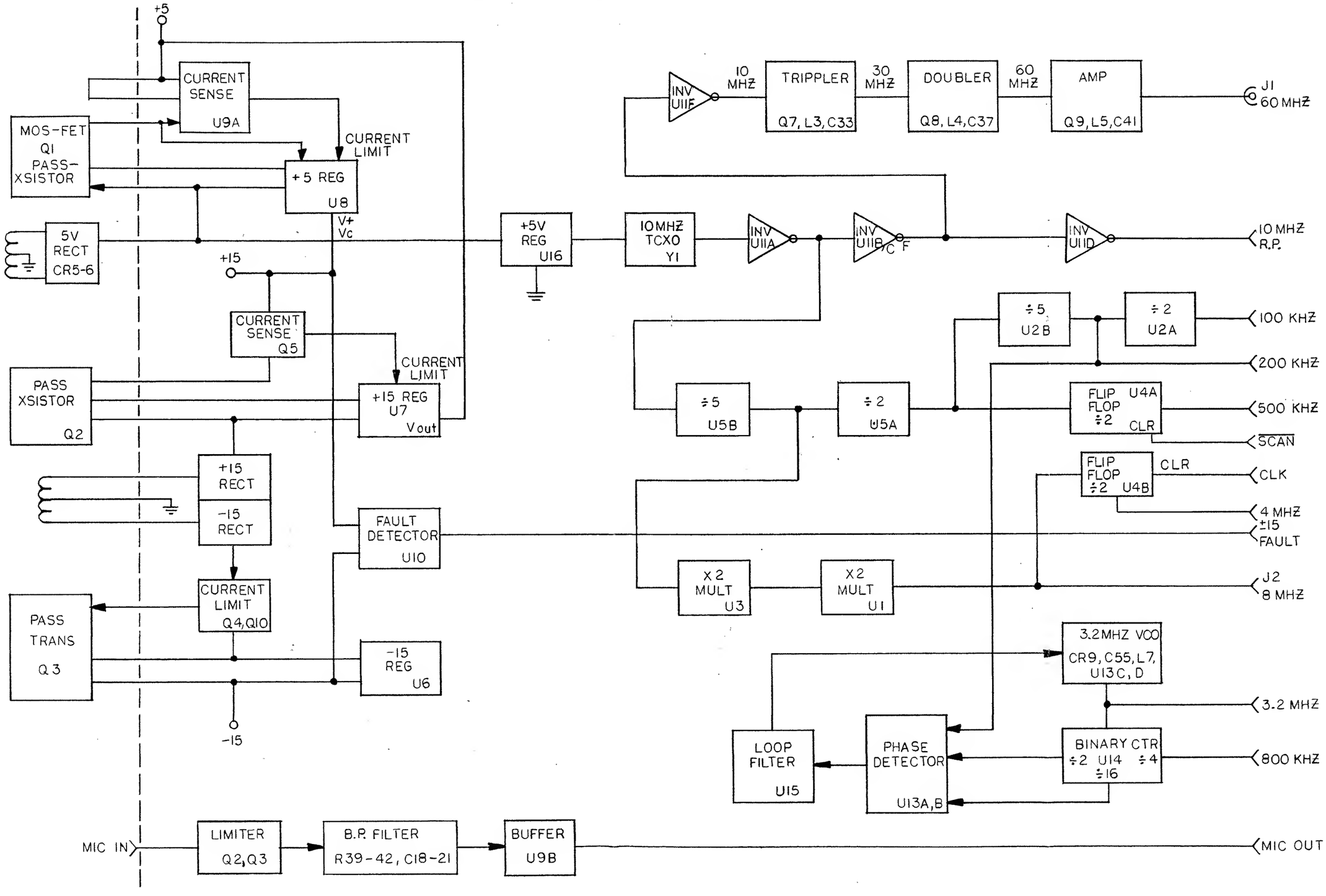
A5 DISTORTION ANALYZER



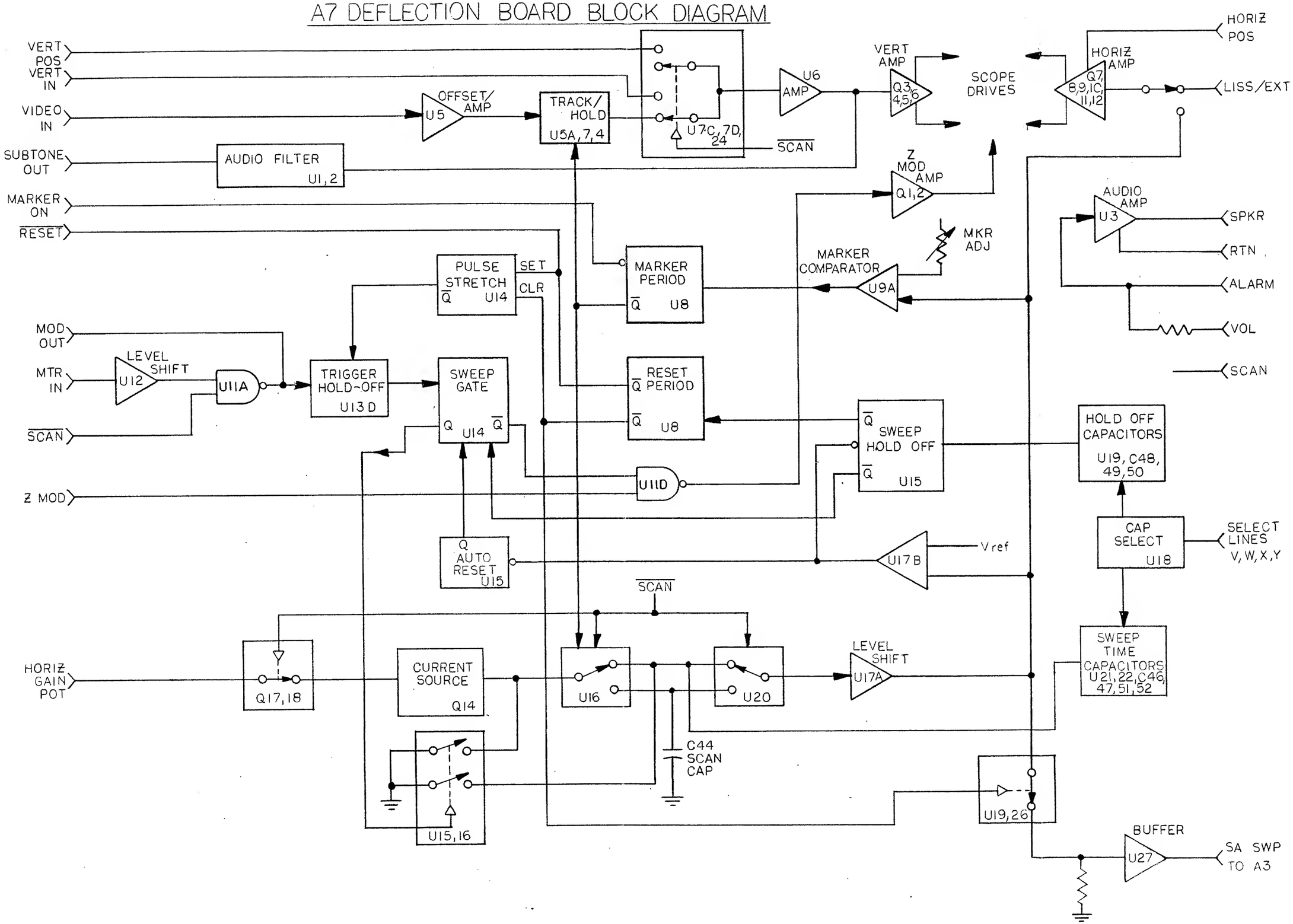
A5 PROGRAMMABLE GAIN CONTROL



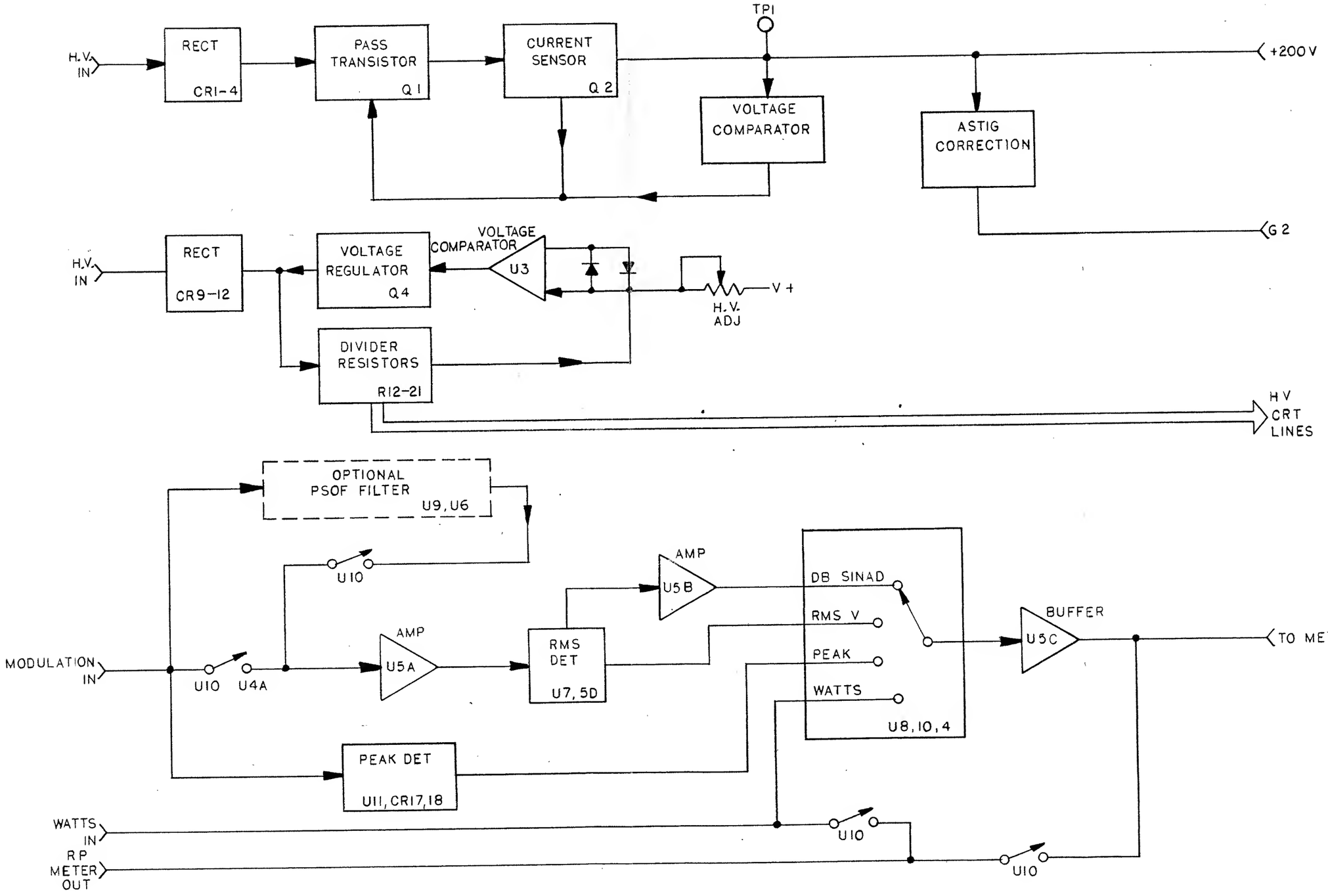
A6 L.V. POWER SUPPLY BLOCK DIAGRAM



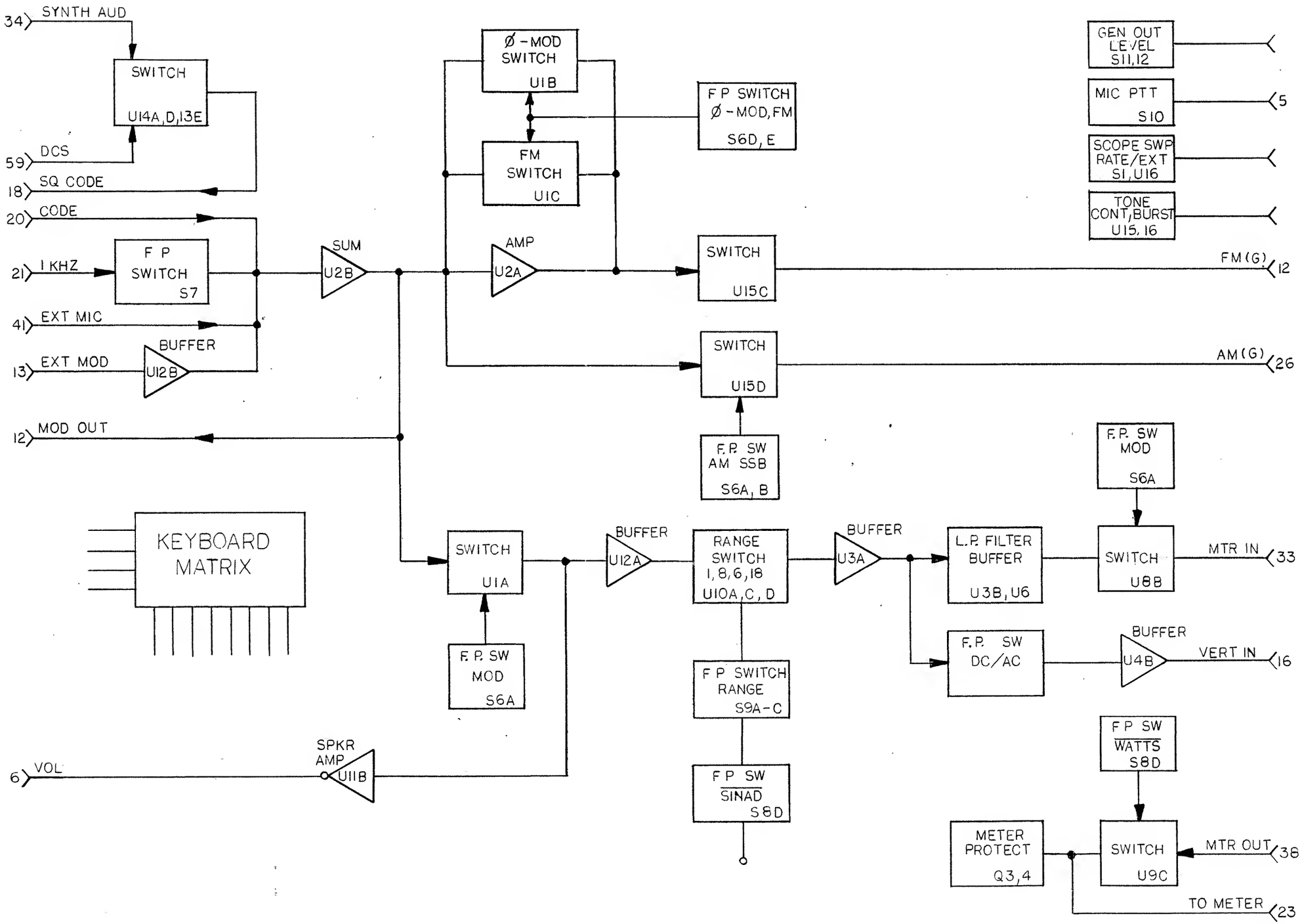
A7 DEFLECTION BOARD BLOCK DIAGRAM



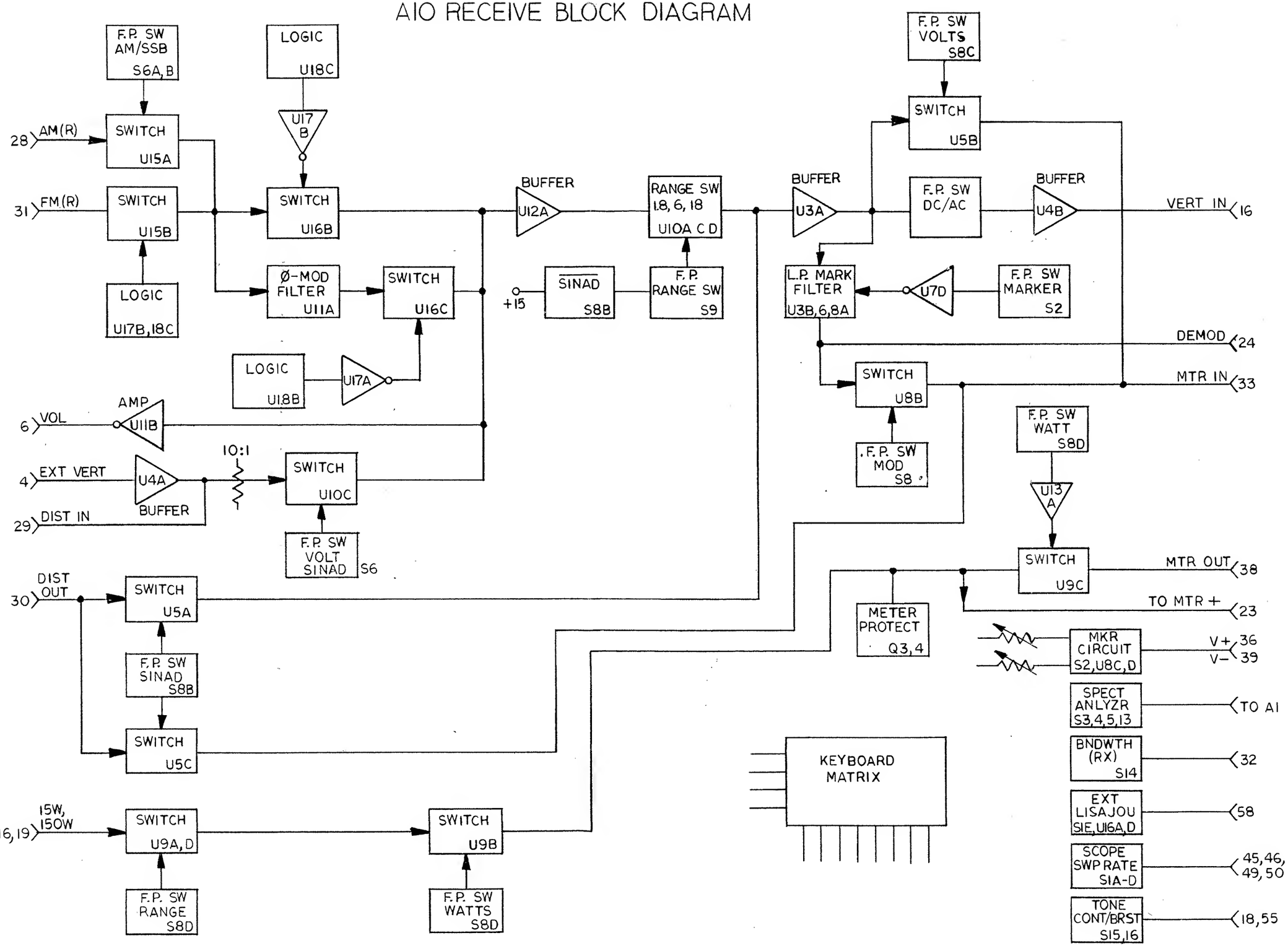
A8 HIGH VOLTAGE POWER SUPPLY BLOCK DIAGRAM



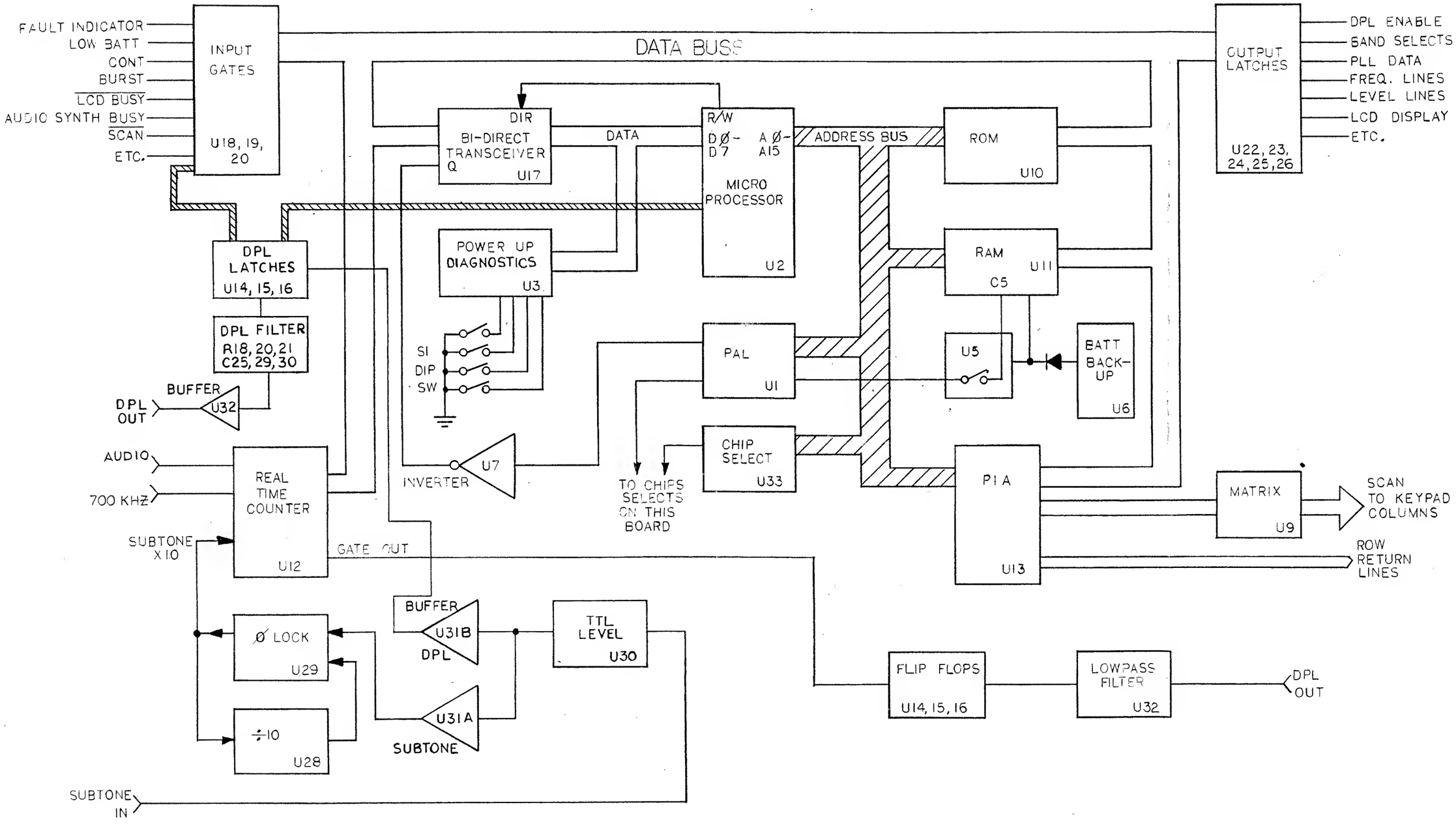
A10 GENERATE BLOCK DIAGRAM



AIO RECEIVE BLOCK DIAGRAM



A11 PROCESSOR BOARD BLOCK DIAGRAM



A12 INVERTER BOARD BLOCK DIAGRAM

EARLY A12

OSC U1

WAVE-SHAPE U2,3B-D,4AC

Ø1

Ø2

LATE A12

E1 5V UNREG

PULSE SENSE

PULSE WIDTH MODULATOR

5 OSC

6

U1

Ø1

Ø2

SELECT LOGIC U6

Hi

Lo

BUFFER Q4,10

BUFFER Q6,8

POWER XSISTORS Q3,9

POWER XSISTORS Q5,7

Ø1,Ø2 HI VOLTAGE WINDINGS

Ø1,Ø2 LOW VOLTAGE WINDINGS

INV

U4B EARLY Q1 LATE

CONTROL GATE U7B

U1-6

11.5V COMPARATOR U8

+12

10.5V COMPARATOR U5B

CONTROL GATE U7B

POWER ON OFF FLIP-FLOP U7C,D

POWER SWITCH Q2

U7

+

F.P. POWER SWITCH

−

+5

E8

11.1 COMPARATOR U5A

OPTO ISOLATOR U9

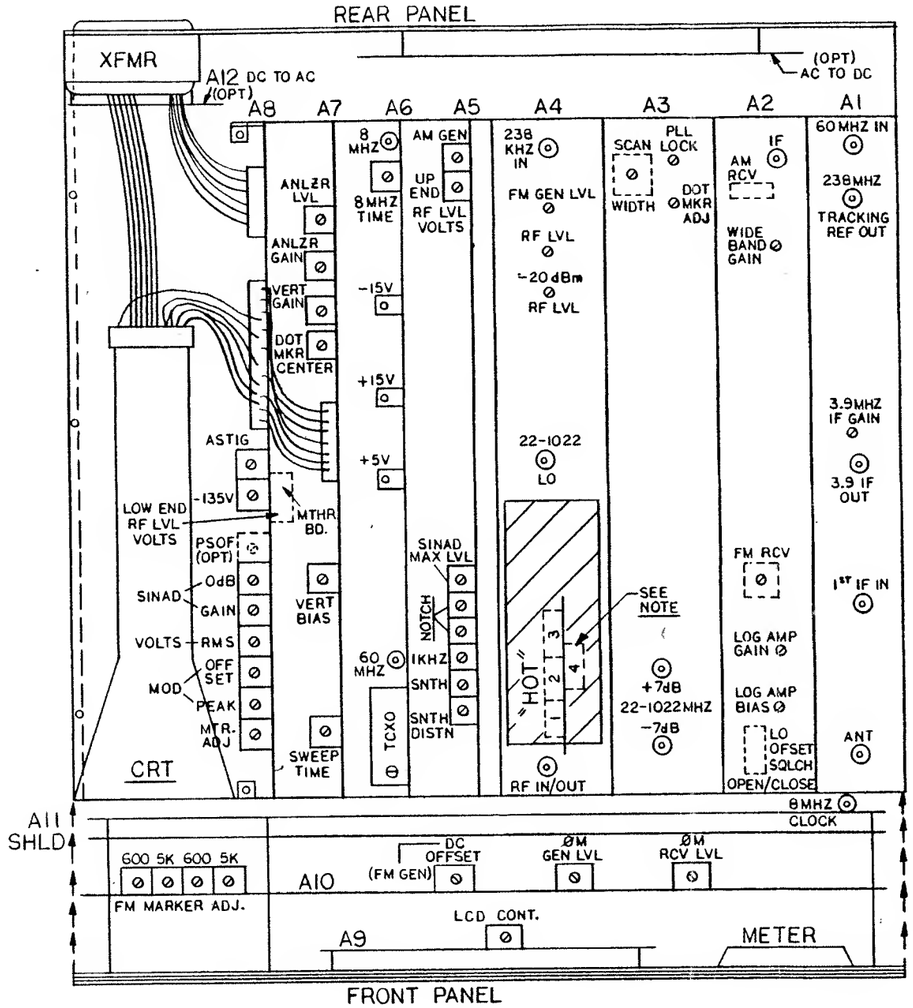
SWITCH Q1

E7

F P LOW-BATT LED

− +

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED



NOTE:
A4 WATT METER ADJ POTS
1 – WATT METER ZERO
2 – 15W
3 – 150W
4 – CELL. RADIO 3.5W MAX
(MEASURED AT REMOTE JACK)

NEXT ASSY	USED ON	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE. FRACTIONS ±1/64 DECIMALS .XX ± .01 .XXX ± .005 ANGLES ±30'	CONTRACT NO.	COMTEST SYSTEMS, INC.
APPLICATION		MATERIAL	APPROVALS / DATE	TOP VIEW 3100
		FINISH	DRAWN D. NOELLER 7-23-86	SIZE C · CODE IDENT NO. 4J835 · DRAWING NO 0719-20-0002
		DO NOT SCALE DRAWING	CHECKED / RELEASED	SCALE · SHEET 1 OF 1

MARBAUGH

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED

REAR PANEL

POWER XFMR ASSY

MIC J1

10MHZ J2

J3

H9 P1 J1

J2 P2 H10

FOCUS INTENSITY

CRT

J1 P1

NORMAL

PSOF

SPEAKER

FAN P1 J1

RED H13 BLACK

E11 E12

H14

E1, 6, 10, & 16

E5

1-6 P2 J2

A8 XA8

A7 XA7

E7 E13

E3 E4

H7

H15

H8

P1 J1

E14 CELLULAR

E8 E9

H11

J1 P1

A13 MOTHER BD.

XP1 1-60

XP2 P2 H1

J1 P1 H6*

* H3 & H6 TO FRONT PANEL POTS, CONNECTOR, ETC.

XA6 A6 XA5 A5 XA4 A4 XA3 A3 XA2 A2 XA1 A1

J2 W6 J2 J5

J1 W7 J4

J3 J1 W8 J3

J1 W5 J2

J1

H4

H12

E2 E4

A9 LCD BD

J1 P1 H5 P2 J2

A11 PROCESSOR BD

J4

J3 H4 J3

A10 SWITCH BD

J2 P2 H3* E

ANT IN

RF IN

W2

W1

W3

W4

FRONT PANEL

NEXT ASSY	USED ON	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS ±1/64 DECIMALS XX ±.01 XXX ±.005 ANGLES ±30'	CONTRACT NO	COMTEST SYSTEMS, INC.	
APPLICATION		DO NOT SCALE DRAWING	APPROVALS / DRAWN D. NOELLER / CHECKED / RELEASED — DATE 7-21-86	CABLE INTERCONNECTION DIAGRAM 3100	
		MATERIAL / FINISH	THIS DOCUMENT CONTAINS INFORMATION PROPRIETARY TO WAVETEK. THE INFORMATION IN THIS DOCUMENT IS NOT TO BE USED OR DUPLICATED IN ANY MANNER WITHOUT THE PRIOR APPROVAL IN WRITING OF WAVETEK	SIZE C	CODE IDENT NO. 4J835	DRAWING NO 0714-20-0002
				SCALE	SHEET 1 OF 1

MARBAUGH

REVISIONS				
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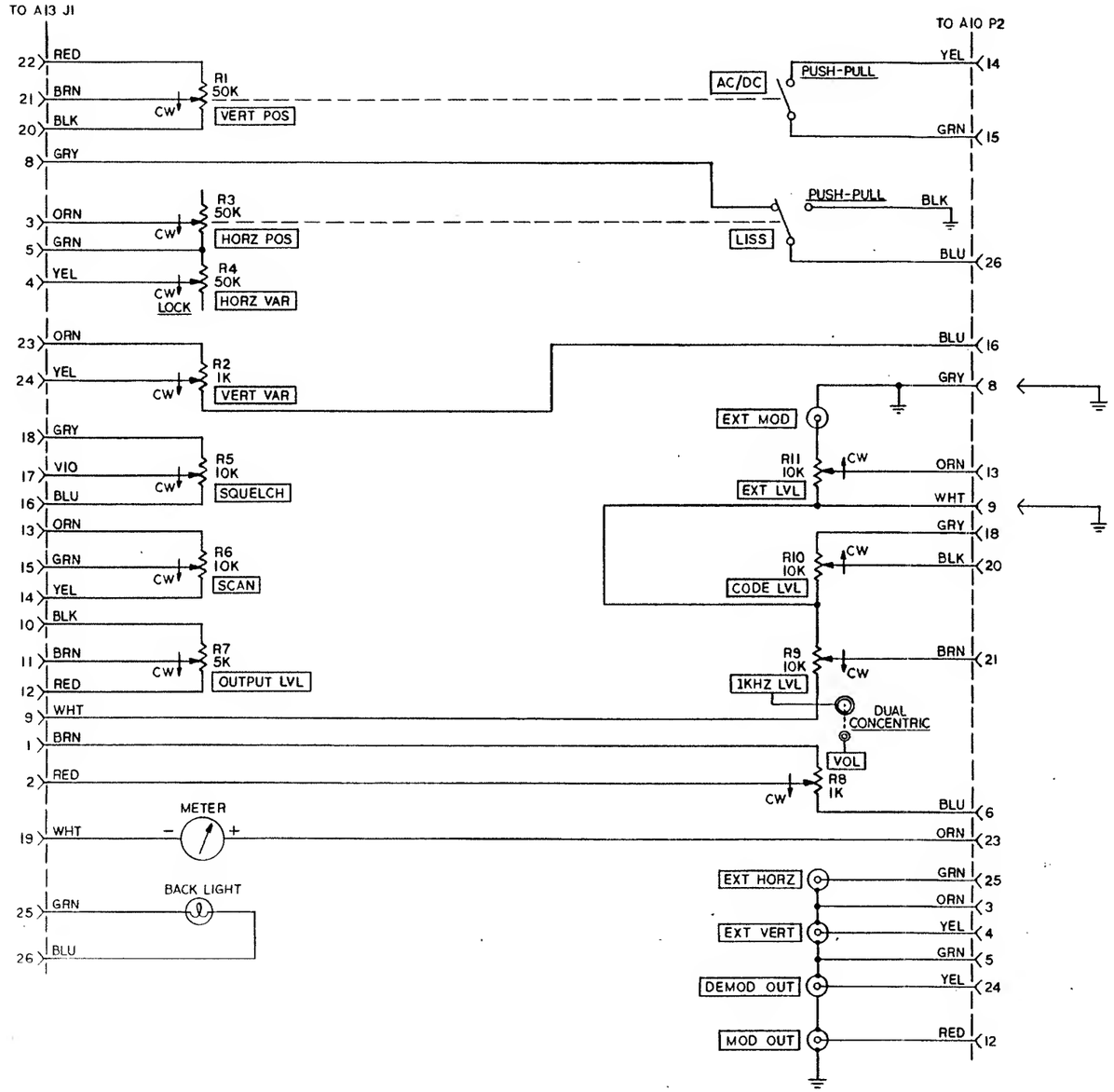
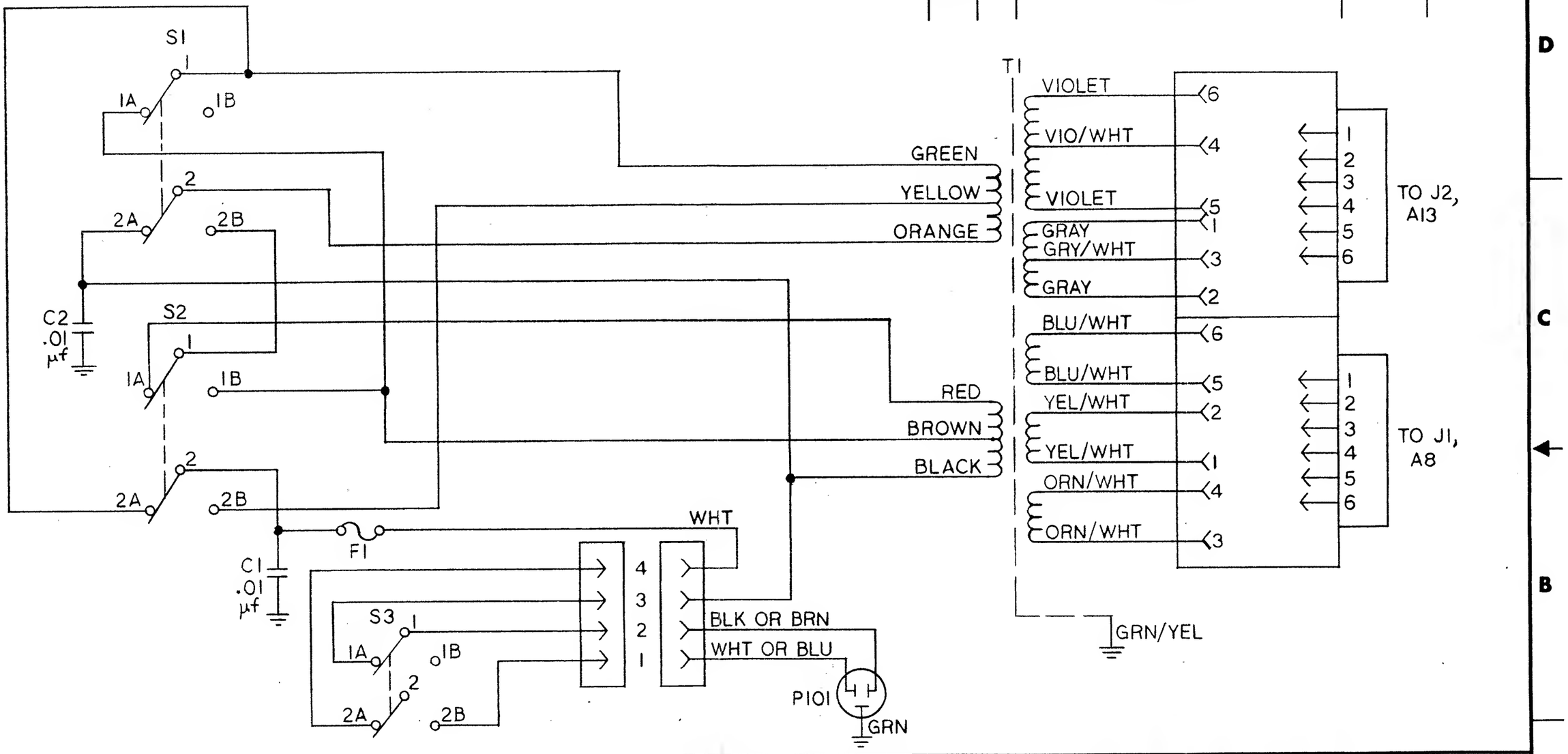


		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS±1/64 DECIMALS .XX ± .01 .XXX ± .005 ANGLES ± 30	CONTRACT NO	COMTEST SYSTEMS, INC.
		MATERIAL	APPROVALS / DRAWN D. MOELLER 7-17-84 / CHECKED / RELEASED	FRONT PANEL WIRING 3100
		FINISH	THIS DOCUMENT CONTAINS PROPRIETARY INFORMATION AND IS LOANED SUBJECT TO AGREEMENT THAT IT IS NOT TO BE USED OR DUPLICATED IN ANY WAY NOR WITHOUT THE PRIOR APPROVAL IN WRITING OF MANUFR.	SIZE D / CODE IDENT NO 4J835 / DRAWING NO 0714-20-0001
NEXT ASSY	USED ON			SCALE / SHEET 1 OF 1
APPLICATION		DO NOT SCALE DRAWING		

IARBAUGH

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED



NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS ±1/64 DECIMALS .XX ±.01 .XXX ±.005 ANGLES ±30'

MATERIAL

FINISH

DO NOT SCALE DRAWING

CONTRACT NO.

APPROVALS	DATE
DRAWN D. NOELLER	8-3-86
CHECKED	
RELEASED	

COMTEST SYSTEMS, INC.

REAR PANEL WIRING 3100

SIZE	CODE IDENT NO.	DRAWING NO.
B	4J835	0714-10-0001

SCALE | SHEET 1 OF 1

MARBAUGH

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
		REV. E REDRAWN	6-25-86	DCM

J4 RF IN
P/O XA1
3 AGC CONTROL
10, L
12, N
J5 IN
-18 dBm
J2
-17dBm 60MHZ
J1
P/O XA1
LVL I
T
TP1
GAIN
J3
8, J
9, K
R DBI1 5
R DBI2 4
3.2 MHZ 21
LO ENABLE 13
CLOCK R
DATA 14
RF ENABLE 15
800 KHZ A
UNLK I 5
+15F
-15F
+5F
+5
-15
77.5-87.7MHZ PLL
60.9901-61.0099MHZ PLL
PRI
PR2
PR3
IF
RF
LO
M1 SBL-1
M2 SBL-1
M3 SBL-1
M4 TFM2
U1 DS8906
U2A TL082
U2B TL082
U3 DS8906
U4A TL082
U5A TL082
U5B TL082
U6 MWA320
U7 CA 3179
U8A TL082
U8B TL082
U9A TL082
U9B TL082
U10 CD 4047
U11 LM339
U12A LM339
U12B LM339
Q1 A400
Q2 A400
Q3 2N4416
Q4 2N4121
Q5 2N4416
Q6 2N 3563
Q7 2N 3563
Q8 2N4121
Q9 2N4121
Q10 2N 4121
Q12 2N4121
T1
IN4444 (X4)
IN5767 (X3)
IN914 (X2)
IN914 (X4)
HSCH 1001
BB105B
R1 110K
R2 1K
R3 47
R4 300
R5 51
R6 75
R7 1.2K
R8 100
R9 12
R10 820 ½W
R11 6.8K
R12 750
R13 390
R14 8.2K
R15 270 ⅛W
R16 68
R17 47K
R18 1.2K
R19 18 ⅛W
R20 270 ⅛W
R21 68
R22 820
R23 2.4K
R24 510
R25 1K
R26 1.2K
R27 33K
R28 5.6K
R29 1.1K
R30 1K
R31 1.1K
R32 68
R33 1K
R34 68
R35 390
R36 10K
R37 10K
R38 10K
R39, 10K
R40 10K
R41 10K
R42 68
R43 68
R44 82
R45 2.2K
R46 820
R47 68
R48 6.8K
R49 5.6K
R50 330
R51 820
R52 6.8K
R53 5.6K
R54 330
R55 1K
R56 2.7K
R57 1K
R58 330
R59 390
R60 220
R62 3K
R63 10K
R64 390
R65 510
R66 68
R69 10K
R70 68
R71 84.5 1%
R72 22K
R73 100K 1%
R74 24K
R75 10K
R82 6.2K
R83 15K
R87 3K
R91 100K 1%
R92 8.2K
R93 22K
R94 820
R95 3.6K
R96 453K 1%
R97, 243K
R98 100K 1%
R99 158K 1%
R100 475K 1%
R101 2.2K
R102 10K
R103 16K
R104 100K 1%
R105 100K, 1%
R106 100K 1%
R107 100K 1%
R108 10K
R109 16K
R110 9.1K
R111 16K
R112 470
R113 100
R114 3.9
R116 100K 1%
R117 100K, 1%
R118 22K
R120 10
R121 182K 1%
R122 120
R123 100K
R124 100
R127 33K
R128 47
R129 100
R131 61.6 1%
R132 221 1%
R133 61.6
R134 61.6 1%
R135 221 1%
R136 61.6 1%
R138 10K
L1 330nh
L2 560nh
L3 560nh
L4 39
L5 39
L6 5T
L7 100
L8 100
L9 120 nh
L10 2T
L11 1
L12 1
L13 1
L14 39
L15 100nh
L16 120 nh
L17 120 nh
L18 2½T
L19 2½T
L20 2½T
L25 5.6
L26 100
L27 3T
L28 100
L29 180nh
L30 100
L31 180nh
L32 3T
L33 5T
C1 .01µf
C2 180
C3 150
C4 100
C5 .01µf
C6 .01
C7 .1µf
C8 .01
C9 .01µf
C10 .01µf
C11 .01µf
C12 .01µf
C13 50
C14 3.6
C15 2.7
C16 .01µf
C17 56
C18 .01
C19 .01µf
C20 .01µf
C21 .01µf
C22 .01µf
C23 .01
C24 .1µf
C25 .1µf
C26 .1µf
C27 .1µf
C28 .1µf
C29 .01
C30 .01µf
C31 .01µf
C32 .01µf
C33 .01
C34 .01
C35 .01µf
C36 .01
C37 15
C38 62
C39 .01
C40 .01µf
C41 .01
C42 .01
C43 68
C44 240
C45 .05
C47 .01
C48 15
C49 100
C50 100µf
C51 .05
C52 .05
C53 56
C54 .01µf
C55 50
C56 .01µf
C57 1µf
C58 .01
C59 .01µf
C60 .01µf
C61 .01µf
C62 .01µf
C63 .01µf
C64 .01
C65 .0033µf
C66 .01µf
C67 10µf
C68 .01
C69 .05
C78 .01µf
C79 5.6
C80 2.2
C82 3.3-18
C83 .01µf
C84 200
C85 330
C86 56
C87 .047
C88 2.2
C89 68
C90 .01µf
C91
C92 470
C93 1µf
C94 10
C95 .0047
C96 .0018
C97 .047 µf
C98 .01 µf
C99 .01µf
C100 .01 µf
C101 .01 µf
C102 .01
C103 .01 µf
C104 .01 µf
C105 .01 µf
C106 .0033
C107 .22 µf
C108 .0033µf
C109, 10µf
C110 33
C111 .01
C112 .01 µf
C113 .01µf
C114 .0033
C115 .01
C116 .01µf
C117 10µf
C118 .01µf
C119 .022 µf
C120 82
C121 1µf
C122 .22µf
C123 1µf
C125 .01 µf
C126 470
C127 .01 µf
C128 18
C129 33
C130 18
C131 82
C132 120
C133 82
C134 .01µf
C135 .01µf
C136 .01
C137 .62
C138 .62
C139 .62
C140 470 µf
CR1 HSCH 1001
CR2 IN5767
CR3 IN5767
CR5 BB105B
CR6
CR7
CR8
CR9
CR10
CR11 IN5767 (X3)
CR12
CR13
CR14
CR15 IN5767 (X3)
CR16
CR17 BB105B
CR18 IN 914 (X2)
CR19
CR20 IN914 (X4)
CR21 IN914
CR22
CR23 IN914 (X4)
CR24 IN5767
CR25 IN5767
CR26 IN5767
CR27 IN5767
CR28 IN5767
CR29 IN 5767
CR30 IN5767
RT1 500
PR2
PR3

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS±1/64 DECIMALS .XX ±.01 .XXX ±.005 ANGLES ±30'	CONTRACT NO		COMTEST SYSTEMS, INC.	
	APPROVALS	DATE	A1 RECEIVER BD 3100	
	DRAWN D. NOELLER	6-25-86		
	CHECKED			
MATERIAL	RELEASED			
FINISH	THIS DOCUMENT CONTAINS INFORMATION PROPRIETARY TO COMTEST SYSTEMS, INC. AND IS NOT TO BE USED OR DUPLICATED IN ANY MANNER WITHOUT PRIOR APPROVAL IN WRITING OF MANUFTR.		SIZE D	CODE IDENT NO 4J835
NEXT ASSY USED ON			DRAWING NO 0714-30-0055	
APPLICATION DO NOT SCALE DRAWING			SCALE	SHEET 1 OF 1

ARBAUGH

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
		REV A DCN F 1007	6 19 84	
4		REV B DCN F 1027	11-13-84	
C3		REV C DCN F-1100	7-2-85	BN

QTY REQD	CODE IDENT	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION

PARTS LIST

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS ± DECIMALS .XX ± .XXX ± ANGLES ±

MATERIAL

FINISH

NEXT ASSY | USED ON

APPLICATION

DO NOT SCALE DRAWING

CONTRACT NO.

APPROVALS	DATE
DRAWN ML	10-24-83
CHECKED RB	10-27-83
RB	12-20-83
RB	1-9-84

COMTEST

A I RECEIVER BD, 3100

SIZE	CODE IDENT NO	DRAWING NO.
C	4J835	0712-50-0055

SCALE | SHEET 1 OF 1

MARSAUGH

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
		REV. F REDRAWN	6-17-86	DCW

P/O XA2

A AI AGC — R1 27K, CR1 IN914, U1S8 TL082, C1 .22µF, CR2 IN914, R2 62K, R3 10K AGC, R4 75K, +15F, -15F, R68 10K

E SCAN — R69 10K, Q13 2N2222

U22C 74C00

U23A 74C00, U22B 74C00

T S5B — R138 10K

2 RCV/DPLX — R6 10K, Q12 2N2222, R5 10K

S AM — R133 27K, U23C 74C00, U22A 74C00, U22D 74C00

19 5IG — Q9 2N2222, R134 12K, CR7 IN914, R135 5.1K, R136 3.3M

3 SQUELCH CONT. — U13B TL082, CR12 IN914, R137 33K

20 AM OUT — R166 10K, R167 12K, AM, C124 180, R168 100, U13A TL082, R169 8.2K, U12A TL082, C109 .0068, R171 4.12K, R173 4.12K 1%, C110 390, C111 .0027µF, R172 4.12K 1%

7 100KHZ — CR13 IN914, C125 .01µF, CR14 IN914, R170 100K, C126 .01µF

17 IF — CR15 HSCH 1001, U18B 74C00, R182 2.2M, U18C 74C00, U18O 74C00, C127 .01µF, R200 1K, C136 .01µF

U14 CD4016, U12B TL082, R141 75K, R143 390K, C91 .22µF, R144 75K, R139 33K, R140 33K, C90 15, R142 20K, R148 20K, C92 .22µF, C93 .22µF, R145 2.2M, R146 2.2M, R147 2.2M

U14 CD4016, R175 100, C115 .22µF, R176 3.6K, R179 1.5M, C117 .001µF, R180 100K, C118 .01µF, R181 13K, U18A 74C00, C113 .22, C112 100, R174 75K, C114 510, L18 100, R178 750, Q11 3N201, C116 100µF, R177 10K, R183 10K, C119 2.2µF

U14 CD4016

U14 CO 4016, R7 2.7K, Q10 2N2222, R8 390K, CR4 IN914, CR5 IN914, R9 10K, R10 4.7K, R11 2K, C50 .22µF, C49 100, R14 200K, C48 560, L1 80, R16 22, C51 2.2, U17 1330, C52 560, C53 .01µF, R17 22, C54 2.2µF, L2 90, U16 1350, R19 18K, C56 .01µF, R20 270, C58 .22, C59 .22, C57 .22, R18 10K

C2, 1, CR3 IN914, U15A TL082, R12 1.2M, R13 360K, C47 .22µF, R15 9.1K, TP6

B (SHT. 2)

A (SHT. 2)

CR6 IN914, R152 22, C95 2.2µF, R153 10K, C94 .01µF, R149 2K, R150 200, U19 CA 3189, C96 .22µF, C97 .22µF, R203 1K, R151 10K, C140 100, C98 470, R154 200, C100 22µF, R155 2K, C99 .01µF, R156 10K

R157 10K, R158 10K, C103 4.7µF, C102 150, R159 50K FM, R160 51K, C104 18, R161 698K 1%, U10A TL082, R162 3.48K 1%, R163 3.48K 1%, C106 .001µF, C105 .0082µF, U10B TL082, TP4, L19 2½T, C107 .05µF, C108 1µF, R164 270, U26 TL 607, R165 1K, R204 150, C131 1µF, P/O XA2, 22

R190 10K, U23D TL082, R191 806 1%, R194 22, C128 10µF, R192 243 1%, C129 .0047µF, U9 LM 555, C130 .01µF, CR11 IN914, R193 10K, CR10 IN914, U11 74C76 PR, U11 74C76, R196 1M, C132 .01, U24B TL082, R195 10K, CALIB X

R184 22, C121 470µF, Q14 2N5949, R189 22, C123 2.2, U21 CD 4046, C120 100, U20 14017 ÷7, R185 1K, R186 100, R187 5.1K, C122 .22µF, R188 10K, 700 KHZ, U24A TL082

R197 270, U25 TL607, R199 10K, R50 10K, C135 10µF, C134 10µF, C133 .05µF, R198 1K, V+ V, V- W, ZMCD 4

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS±1/64 DECIMALS XX ±.01 XXX ±.005 ANGLES ±30'	CONTRACT NO	COMTEST SYSTEMS, INC.	
MATERIAL	APPROVALS / DRAWN D. NOELLER / CHECKED / RELEASED	A2 IF AMPLIFIER	3100
FINISH	DATE 6-17-86	SIZE D	CODE IDENT NO. 4J835
NEXT ASSY / USED ON / APPLICATION	DO NOT SCALE DRAWING	SCALE	DRAWING NO 0714-30-0052
THIS DOCUMENT CONTAINS INFORMATION PROPRIETARY TO COMTEST SYSTEMS, INC. AND SHALL NOT BE REPRODUCED OR TRANSMITTED TO BE USED FOR ANY PURPOSE WITHOUT THE PRIOR APPROVAL IN WRITING OF COMTEST		SHEET 1 OF 2	

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
		REV. F REDRAWN	6-9-86	DCN

P/O XA2

3.2MHZ 16

WIDE Z

J1 C3 .01 R23 39 R22 1.2K C55 .01 R21 5.6K C138 10 R24 4.7K C4 .01 L3 1 C5 1500 C6 82 Q1 2N3563 R25 39 R26 1.2K C9 .01 R27 5.6K R202 10 -15F C7 470 C8 .01 C10 1500 L4 1 R28 4.7K R31 12K C11 82 R32 560 TP1 R29 20K Q5 2N4121 +15S +15 R30 20K R39 20K C137 .01 R41 20K Q8 2N2222 R40 33 C20 .01 (B) (SHT. 1)

U1 LM1496 R34 500 R33 200 C12 39 R35 2.2K C16 1 C15 470 -15 R37 51 C13 1 +5 R36 1K C14 10 R38 510 C19 1 C18 120 C17 1

L5 82 C21 390 R45 39K R44 20K -15F R47 10 R48 5.1K Q6 2N 2222 Q7 2N2222 R49 681 1% R43 487 1% R42 5.1K -15 RT1 1K C22 .01 C23 2.2 R52 510 R51 2.2K -15F C24 .22 R53 220K

U2 TL607 R54 270 -15 C25 10 C141 10 R55 220 K L6 330 C28 120 C139 18 L7 330 C30 150 L8 330 C32 120 C35 27 C27 2.4 C29 2.4 C33 8.2 R60 220K C26 270 L23 180 C31 270 R56 390 R57 500 WIDE R58 150 R59 390

U3 TL607 R61 1K R63 1K C34 1 C37 1 R62 10K +5F C40 1 TP2 C38 .01 R65 220K R64 1K -15 C36 1 R66 1.37K 1% R67 8.66K 1% (A) (SHT. 1)

P/O XA2 B VIDEO U8 TL082 R70 390K CR16 HSCH 1001 (X2) CR17 C61 .22 C60 .0047 R71 180K R72 100K BIAS TP5 TP3 Q4 2N2222 Q3 2N2222 R73 150 C62 10 C64 .05 R74 5K AMPL R75 2K L17 5.6 mH R76 9.1K R78 16.2K 1% C63 .01 R81 1.33K 1% -15 +15F

U7 CA3054 R82 1K 1% C65 1 CR 18 IN 914 R80 3.32K 1% R83 1K 1% R84 1K 1% R87 1K 1% R88 19.1K 1% R79 19.1K 1% C66 .01 R85 4.75K 1% L16 5.6mH R77 1K 1% R86 1.5K 1% R90 10.7K 1% C68 .01 C101 1 R89 4.75K 1% C69 .01 L15 5.6mH +15S

U6 CA3054 R94 1K 1% C71 1 CR 19 IN 914 R93 3.32K 1% R95 1K 1% R99 1K 1% R100 1K 1% R101 19.1K 1% R96 19.1K 1% C72 .01 R98 4.75K 1% L14 5.6mH R97 1K 1% R104 1.5K 1% R103 16.2K 1% C75 .01 C73 1 R102 4.75K 1% C76 .01 L13 5.6mH C70 .01 R92 1.5K 1% R91 16.2K 1%

U5 CA3054 R110 1K 1% C80 1 CR 20 IN 914 R106 3.32K 1% R111 1K 1% R115 1K 1% R116 1K 1% R117 19.1K 1% R109 19.1K 1% C79 .01 R112 4.75K 1% L12 5.6mH R108 1K 1% R113 1.5K 1% R114 16.2K 1% C83 .01 C78 1 R118 4.75K 1% C82 .01 L11 5.6mH C77 .01 R105 1.5K 1% R107 16.2K 1%

U4 CA3054 R124 1K 1% C85 1 CR 21 IN 914 R123 3.32K 1% R125 1K 1% R126 1K 1% R127 1K 1% R128 19.1K 1% R122 19.1K 1% C87 4.75K 1% L10 5.6mH R121 1K 1% R130 1.5K 1% R132 15K 1% C88 1 C89 .01 R131 7.5K 1% L9 5.6mH C84 .01 R119 1.54K 1% R120 17.4K 1% R201 10 +15F

+15F L21 2½T C43 .01 C44 .01 (9, K)

+5F L22 2½T C46 .01 C45 .01 (11, M)

12, N GND

10, L

8, J L20 2½T C42 .01 C41 .01 -15F

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS±1/64 DECIMALS XX ± .01 XXX ± .005 ANGLES ± 30'	CONTRACT NO		COMTEST SYSTEMS, INC.		
	APPROVALS	DATE	A2 IF AMPLIFIER 3100		
MATERIAL	DRAWN D. NEELLER	6-9-86			
FINISH	CHECKED		SIZE D	CODE IDENT NO. 4J835	DRAWING NO. 0714-30-0052
NEXT ASSY USED ON APPLICATION	RELEASED		SCALE		SHEET 2 OF 2
DO NOT SCALE DRAWING	THIS DOCUMENT CONTAINS INFORMATION PROPRIETARY TO COMTEST SYS. INC. THE INFORMATION ON THIS DOCUMENT IS NOT TO BE REPRODUCED OR DISCLOSED TO OTHERS OUTSIDE THE RECIPIENT COMPANY IN WHOLE OR IN PART WITHOUT THE WRITTEN PERMISSION OF COMTEST SYS. INC.				

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
		REV A DCN F 1009	6-21-84	LRR
		REV B DCN F 1041	1-3-85	MP
		REV C DCN F-1093	7-19-85	RB

QTY REQD	CODE IDENT	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION

PARTS LIST

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS ± DECIMALS .XX ± .XXX ± ANGLES ±

MATERIAL

FINISH

DO NOT SCALE DRAWING

CONTRACT NO.

APPROVALS	DATE
DRAWN R.B	12-22-83
CHECKED	

NEXT ASSY | USED ON

APPLICATION

COMTEST

A2 IF 3100

SIZE	CODE IDENT NO.	DRAWING NO.
C	4J835	0712-50-0052

SCALE | SHEET 1 OF 1

MARBAUGH

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
		REV. H REDRAWN	7-1-86	DCN

240-505MHZ VCO

SAMPLER

÷2 ÷4 ÷8

OFFSET

MKR

P/O XA3

LVL 3

TEST
SMPL
VCO TEST
A3 ENABLE
CLOCK
DATA
4MHZ
RESET
CLK
SCAN
UNLK3

B5 X
L 10
N 12
V W 19
B6 20
B1 Z
B2 22
B3 Y
B4 21
5WP 5
5WP RTN 4

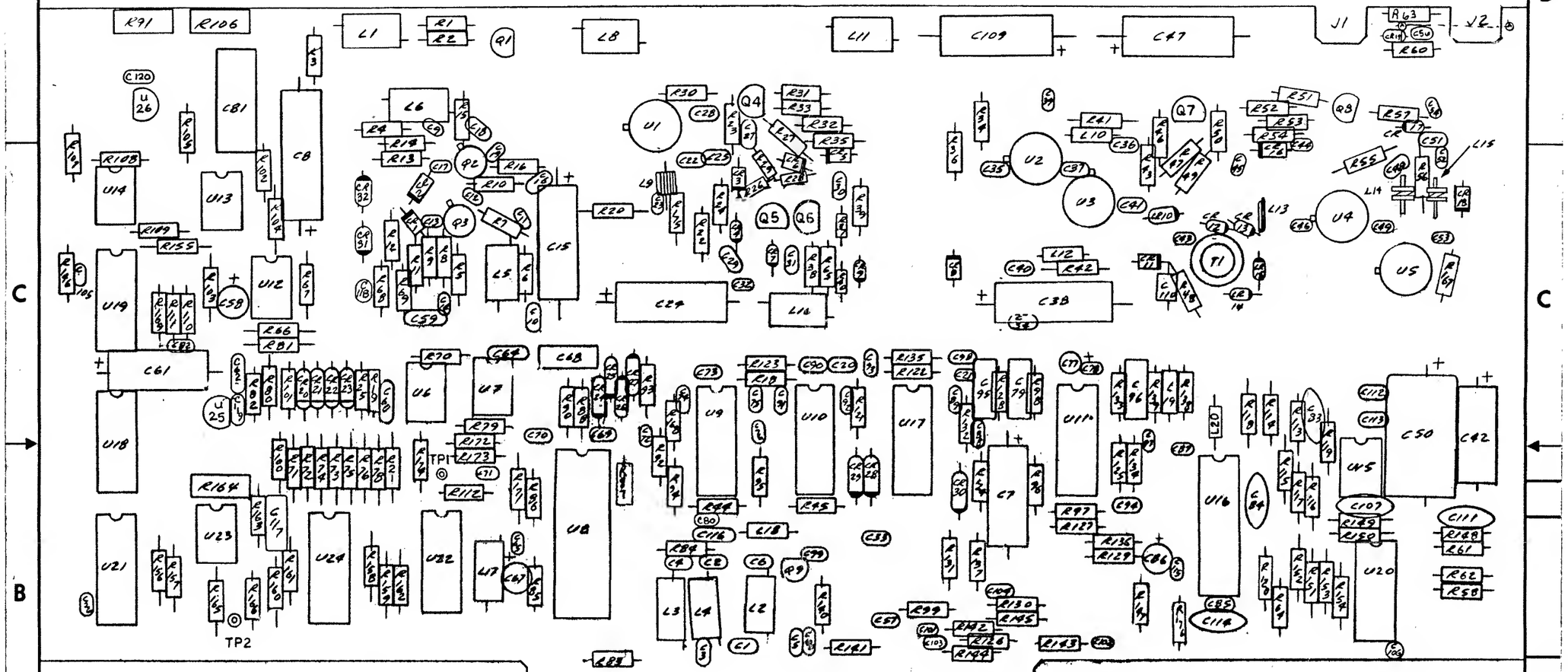
SCAN

(ALL 1%)

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE FRACTIONS±1/64 DECIMALS ANGLES .X±.05 .XX±.010 ±30	CONTRACT NO			COMTEST SYSTEMS, INC.
	APPROVALS	DATE		A3
	DRAWN D. NOELLER	7/1/86		HI FREQ. SYNTHESIZER 3100
MATERIAL	CHECKED			
	RELEASED		SIZE D	CODE IDENT NO 4J835
FINISH			SCALE	SHEET 1 OF 1
NEXT ASSY USED ON APPLICATION	DO NOT SCALE DRAWING			DRAWING NO 0714-30-0066

THIS DOCUMENT CONTAINS INFORMATION PROPRIETARY TO COMTEST SYSTEMS, INC. AND IS NOT TO BE REPRODUCED OR DISCLOSED TO OTHERS OUTSIDE OF THE COMPANY WITHOUT THE WRITTEN APPROVAL OF COMTEST SYSTEMS, INC.

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
		REV A DCN F 1012	6 29 84	DLR
		REV B DCN F-1030	11-19-84	DLR
		REV C DCN F-1106	8-2-85	BN



QTY REQD	CODE IDENT	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION

PARTS LIST

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS ± DECIMALS .XX ± .XXX ± ANGLES ±

MATERIAL

FINISH

DO NOT SCALE DRAWING

CONTRACT NO.

APPROVALS	DATE
DRAWN K	3/21/94
CHECKED	

NEXT ASSY	USED ON
APPLICATION	

COMTEST

3100
A3 FREQ SYN

SIZE	CODE IDENT NO.	DRAWING NO.
C	4J835	0712-50-0066

SCALE

SHEET 1 OF 1

MARBAUGH

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
		REV. D REDRAWN	4-29-86	DCN

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS±1/64 DECIMALS .XX±.01 .XXX±.005 ANGLES ±30	CONTRACT NO	COMTEST SYSTEMS, INC.	
	APPROVALS / DRAWN D. NOELLER 4-29-86 / CHECKED / RELEASED	A4 GENERATOR BD. 3100	
MATERIAL		SIZE D · CODE IDENT NO. 4J835 · DRAWING NO. 0714-30-0065	
FINISH	THIS DOCUMENT CONTAINS INFORMATION PROPRIETARY TO COMTEST SYSTEMS, INC. AND IS NOT TO BE LOANED OR DISCLOSED IN ANY WAY WITHOUT THE PRIOR APPROVAL IN WRITING OF MANAGER.	SCALE	SHEET 1 OF 2
NEXT ASSY / USED ON / APPLICATION	DO NOT SCALE DRAWING		

(A) (SHT. 2) (B) (SHT. 2) (C) (SHT. 2) (D) (SHT. 2) (E) (SHT. 2) (F) (SHT. 2)

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
		—	5-29-84	RA
		REV A DCN F-1008	6-18-84	DLR

ZONE	LTR	DESCRIPTION	DATE	APPROVED
		REV B DCN F-1031	11-27-84	[illegible]
		REV C DCN F-1045	1-22-84	[illegible]
		REV D	10-12-87	JPC

QTY REQD	CODE IDENT	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION

PARTS LIST

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS ± DECIMALS .XX ± .XXX ± ANGLES ±

MATERIAL

FINISH

DO NOT SCALE DRAWING

CONTRACT NO.

APPROVALS	DATE
DRAWN R.A	2-25-84
CHECKED	

NEXT ASSY | USED ON
APPLICATION

COMTEST

A4 GENERATOR BD REV 3100

SIZE	CODE IDENT NO.	DRAWING NO.
C	4J835	0712-50-0065

SCALE | SHEET 1 OF 1

MARBAUGH

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
		REV. G REDRAWN	6-5-86	DCN

J2 22-1022 MHZ

U17 MWA310 · U18 MWA320 · U19 MWA330 · U23 MWA310 · U24 MWA320 · U25 MWA330

M2 TFM-2 · T1 8IFILAR · AT4 30dB 150W · J3

K1 · K2

P/O XA2 → 10, 12, 13, 16, 17, 18, 19, 20, L, N, P, T, GND

Q9 2N3563 · Q10 2N4121 · Q11 2N3563 · Q12 2N4121 · Q13 2N4121 · Q14 2N4121 · Q8 2N3563 · Q17 2N4403

U15A TL082 · U16A TL082 · U16B TL082 · U158 TL082

DB02 · DB03

U20A TL082 · U21A TL082 · U21B TL082 · U22 555 · U208 TL082

Q15 2N2222 · Q16 2N4403 · Q18 2N4403 · Q19 2N2222

P/O XA2 → +5 UNREG

15W Z · 150W Y · ALARM W · CELL WATTS 21 · 100° 22 · MV V · WATTS X

(A) (SHT. 1) · (B) (SHT. 1) · (C) (SHT. 1) · (D) (SHT. 1)

(E) (SHT 1) · (F) (SHT 1)

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE FRACTIONS/DECIMALS ANGLES .1/.64 XX ±.01 XXX ±.005 ±30'	CONTRACT NO.		COMTEST SYSTEMS, INC.	
MATERIAL	APPROVALS	DATE	A4 GENERATOR BD. 3100	
FINISH	DRAWN D. JOELLER	6-5-86	SIZE D · CODE IDENT NO. 4J835 · DRAWING NO. 0714-30-0065	
NEXT ASSY · USED ON	CHECKED		SCALE	SHEET 2 OF 2
APPLICATION · DO NOT SCALE DRAWING	RELEASED		THIS DOCUMENT CONTAINS INFORMATION PROPRIETARY TO MARCH, INC. IT IS LOANED FOR BIDDING PURPOSES ONLY AND IS NOT TO BE REPRODUCED, COPIED OR USED FOR ANY PURPOSE WHATSOEVER WITHOUT THE PRIOR APPROVAL IN WRITING OF MARCH.	

MARBAUGH

REV	ECN	BY	DATE	APP
A	REVISED	DCN	7/86	DCN

IC PIN POWER & GROUND TABLE

IC#	GND	+5V	+15V	-15V
1	7, 8, 15	2, 10, 10		
2	0, 7, 8, 16		14	
3	8, 7, 8	14		
4	20	2, 38, 37 38, 40, 15		
5	12, 16	21, 24		
7, 8, 10, 37	7	14		
9, 43, 44	8	1, 2, 7, 9, 16	18	
11	4, 8	8, 16		
12	4, 8, 10, 11, 12, 13		18	

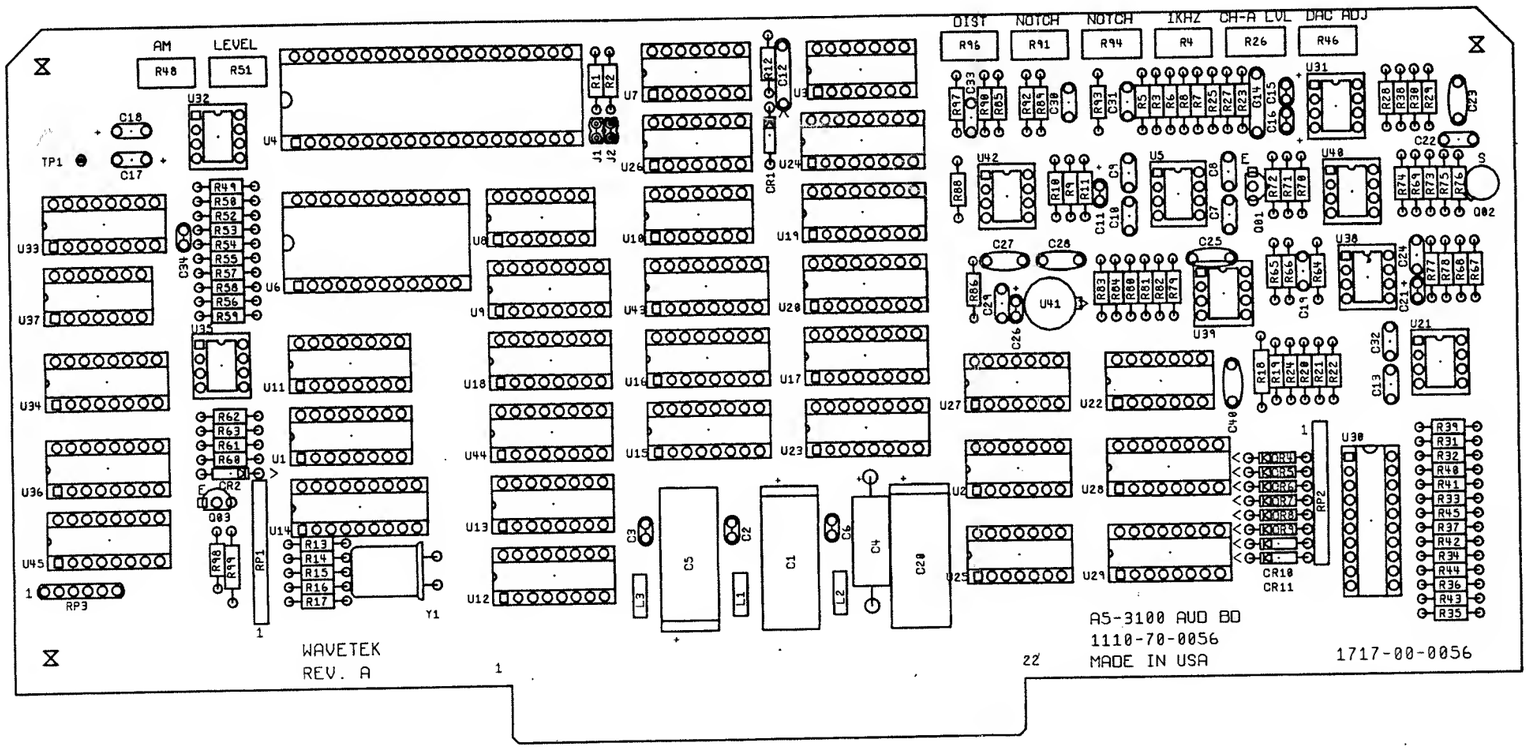
IC#	GND	+5V	+15V	-15V
13, 15, 18, 20, 23	8		8, 16	
14	8, 8	1		
15, 17, 18	4, 8, 13		18	
26	5, 6, 7, 8, 9, 12, 13		14	
26	8, 7, 8, 10	5, 14		
27	3, 8, 7, 10		11, 14	
28	3, 4, 8, 8, 12, 13		18	
28	3, 8, 9, 12		4, 13, 18	
30	18, 15, 16	20		

IC#	GND	+5V	+15V	-15V
33, 34, 36	5	13		4
41	1, 5		3	
3, 21, 31	AS SHOWN		8	4
32, 35, 38	AB SHOWN		8	4
39, 40, 42	AD SHOWN		8	4
22	7, 11, 12, 13		14	
45	8, 10	10		
24	7, 8, 18		2, 10, 16	

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN B. ABEL	DATE 13:50 12 AUG 1985	COMTEST SYSTEMS, INC.
MATERIAL	PROJ ENGR D. RENICK		TITLE SCHEM / ASSY / TEST SET
	RELEASE APPROV D. RENICK		SCHEMATIC DRAWING A5 AUDIO BD
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ANGLES .XX		
	DO NOT SCALE DWG	MODEL NO. 3100	DWG NO. 0714-30-0056 REV C
	SCALE 1:1		
	2M.0303.RC /V	CODE IDENT 4J835	SIA SHEET 1 OF 1

0714-30-0056 C

REV	ECN	BY	DATE	APP



ASSEMBLY NOTES

1. COMPONENT ASSEMBLY AND CLEANLINESS SHALL BE IN ACCORDANCE WITH IPC/ASTM STD 610 CLASS II.
2. COMPONENTS ARE IDENTIFIED BY REFERENCE DESIGNATIONS AND NOT BY ITEM NUMBER.
3. THE MAXIMUM HEIGHT ON THE SOLDER SIDE OF THE BOARD WILL BE 0.063 INCH WHICH INCLUDES CLIPPED OR CLENCHED COMPONENT LEADS AND SOLDER MENISCUS. SOLDER ELECTRICAL CONNECTIONS USING ITEM NUMBER.
4. COMPLETION DATE CODE SHALL BE MARKED ON FINISHED ASSEMBLY IN VIEWABLE POSITION.
5. GOLD PLATED EDGE CONTACTS SHALL NOT BE SOLDERED UNLESS OTHERWISE SPECIFIED.
6. REFERENCE: SCHEMATIC 0716-38-0056.
7. REFERENCE: TEST PROCEDURE AND REQUIREMENTS 0716-85-0010.
8. REFERENCE DESIGNATIONS SHOWN ON COMPONENTS ARE FOR REFERENCE ONLY AND DO APPEAR IN THE ACTUAL PART.

NOTE: UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN B. ABEL	DATE 11:39 23AUG 1985	COMTEST
MATERIAL	PROJ ENGR D. RENICK		TITLE SCHEM / ASSY / TEST SET
	RELEASE APPROV D. RENICK		TOP ASSEMBLY DWG A5 AUDIO SYNTH
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ANGLES .XX		
	DO NOT SCALE DWG	MODEL NO. 3100	DWG NO. 0712-50-0056 REV A
	SCALE 2:1	CODE IDENT 4J83S	A1A SHEET 1 OF 1
	ZM.83883.RC /V4.FAB		

0712-50-0056 A

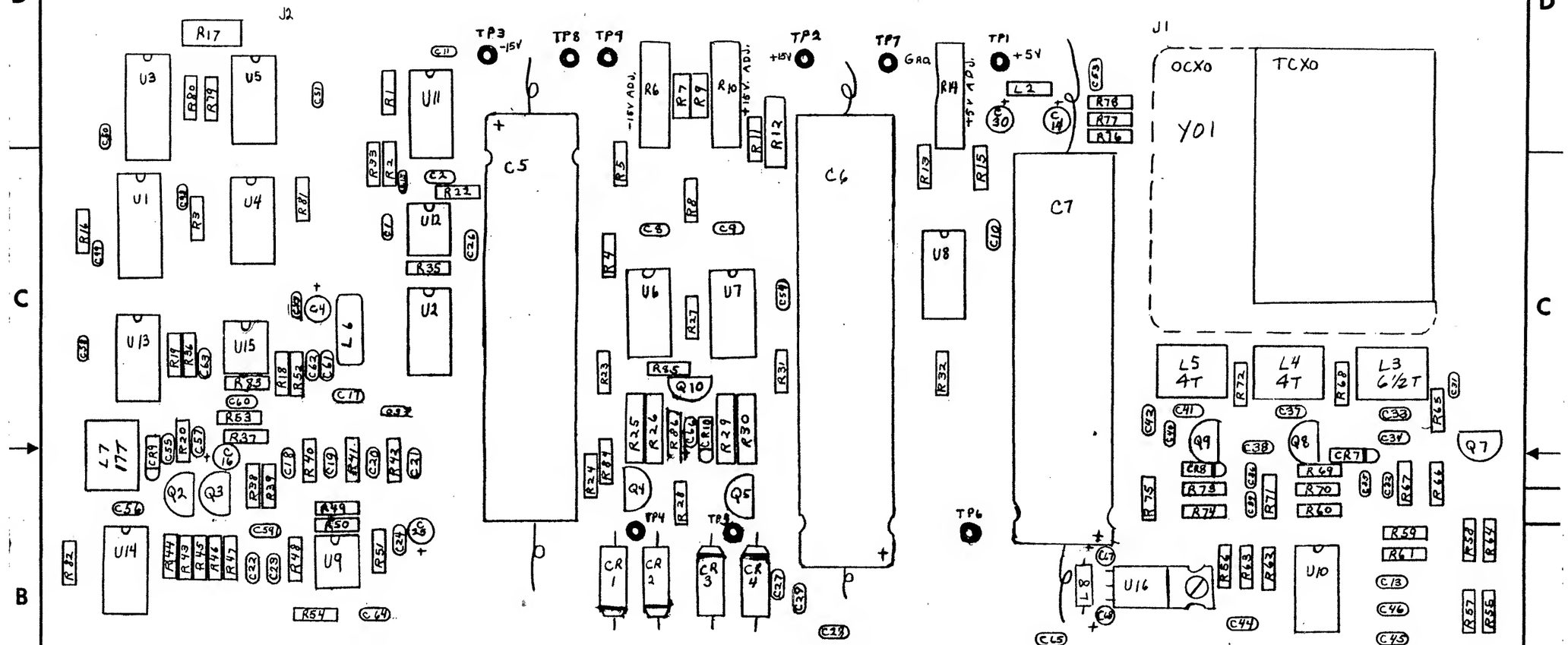
REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
		REV. H REDRAWN	3-25-86	DCN

P/O XA6
18, V
25, C
1, 2
24, B
23, A
26, D
27, E
19, W
22, Z
16, T
13, P
14, R
20, X
11, M
12, N
17, 21, U
10, L
9, K
8, J
15, S
5
30
4
MIC IN
E
MIC OUT
CHASSIS
SOURCE
GATE
DRAIN
Q1
Q2 TIP 32
Q3 TIP 31
J6
7V
7V
15 V
15 V
U16 7805
L8 100
C68 10µf
C67 10µf
TP1 +5V
Y1 TCXO 10MHZ
C29 .05µf
TP8
TP6
TP9
C25 4.7µf
U9A TL082
R49 10K
R48, 82K
C59, .01µf
R32 10K
C10 .001µf
U8 723
C7 8000µf
CR5 IN5825
CR6 IN5825
R15 750, 1%
R14 500
R13 2.21K 1%
L2 100
C30 10µf
C14 10µf
C54 .01µf
TP2 +15V
R29 1Ω ½W
R30 1Ω ½W
R87 1Ω ½W
Q5 2N4356
TP5
R31 180
U7 723
CR4, MR501
CR3 MR501
R12 220 ½W
R27 1.96K 1%
C6 4000µf
C9 100
R8 1.5K
R11 3.83K 1%
R10 500
R9 3.40K 1%
TP4
CR2, MR501
CR1 MR501
R25 1Ω ½W
R26 1Ω ½W
R84 100
Q4 2N2222
R28 470
C5 2200µf
R86 4.7K
R24 100
Q10 2N4356
TP3
R4 6.19K 1%
R5 3.83K 1%
R23 6.19K, 1%
C8 470
R6 1K
R7 13.7K 1%
U6 723
R85 100
CR10 IN 5233
C66 1µf
C64 680
C65 680
C27 .05µf
R60 10.2K 1%
R62 24.3K 1%
C28 .05µf
R63 4.75K 1%
C44 .05µf
R64 11K 1%
C45 .05µf
R55 10K 1%
R58 10K 1%
C13 .05µf
R57 10.2K 1%
R59 1K 1%
C46 .05µf
R61 3.01K 1%
R54 240
R82 240
R53 10K
R56 4.7K
U10A LM339
U10B LM339
U10C LM339
U10D LM339
U14 74LS93
U13D 74LS86
U13C 74LS86
U13B 74LS86
U13A 74LS86
R20 510
L7 0.080 17T
C56 1800
CR9 SQ151
C55 360
C57 1800
C58 .1µf
R83 1.1M
C60 .01µf
C63 360
R19 1.1M
R36 11K
R18 3.3M
U15 TL081
C61 3.3 -15
C62 .01µf
R52 10M
LIMITER/FILTER
C17 .05µf
R37 1.10K 1%
C16 1µf
R39 39.2K 1%
C18 1000
R40 133K 1%
R41 205K 1%
C19 1000
C20 1000
R42 7.15K 1%
C21 1000
U9B TL082
R51 100K 1%
R50 100K 1%
C24 .22µf
C22 .05µf
Q3 2N2222
Q2 2N2222
R46 499 1%
R44 499 1%
R45 75K 1%
C23 .05µf -15
R47 47K
R43 47K
R38 10K 1%
+15
-15
C32 .01µf
R67 5.1K
L3 6½T .21µh
C33 75
R66 3M
Q7 2N2222
R65 1K
C31 33
C34 10
R68 33
CR7 IN914
R69 3.3K
R70 3.9K
C35 .01µf
Q8 2N2222
C36 .01µf
R71 1.8K
L4 4T .13µh
C37 33
C38 4.7
R72 33
CR8 IN914
R73 3.3K
R74 3.9K
C39 .01µf
Q9 2N2222
C40 .01µf
R75 1.8K
L5 4T .13µh
C41 33
C42 4.7
R77 150
R76 75
R78 75
J1 60MHZ
C53 .01µf
TP7
TCXO & 60MHZ GND
35, P
36, R
U11A 74LS04
R1 6.8K
U11B 74LS04
U11C 74LS04
U11F 74LS04
C11 .01µf
U11E 74LS04
U11D 74LS04
C2 .001µf
R22 100
C26 330
R35 100
C15 .01µf
R2 1M
R33 1M
C1 .01µf
U12 CA3130
10MHZ (R.P)
6
200KHZ
H
F
U2 74C90
U5 74LS90
U4A 74LS74
500KHZ
B
SCAN
3
2MHZ
7
4MHZ
C
CLOCK
A
L6 2½T
C47 .01µf
C4 10µf
U4B 74LS74
J2
R81 100
C51 82
R79 4.7K
R80 4.7K
R17 5K
C50 82
R3 4.7K
C48 8.2
R16 4.7K
C49 27
U3A 74123
U3B 74123
U1A 74123
U1B 74123
+15/-15 FAULT
31

		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS±1/64 DECIMALS .XX ± .01 .XXX ± .005 ANGLES ±30	CONTRACT NO	COMTEST SYSTEMS, INC.
		MATERIAL	APPROVALS / DATE	A6 LOW VOLTAGE POW. SUPPLY 3100
		FINISH	DRAWN D.L.NOELLER 3-25-86	
			CHECKED	
NEXT ASSY	USED ON		RELEASED	
APPLICATION		DO NOT SCALE DRAWING	THIS DOCUMENT CONTAINS INFORMATION PROPRIETARY TO COMTEST SYSTEMS, INC. AND IS NOT TO BE REPRODUCED OR USED FOR ANY PURPOSE WITHOUT THE PRIOR APPROVAL IN WRITING OF COMTEST	SIZE D / CODE IDENT NO 4J835 / DRAWING NO 0714-30-0057 / SCALE ~ / SHEET 1 OF 1

MARSAUGH

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
		REV D DCN F1038	12-13-84	N. PARKER
2	D	REV. E DCN F1057 ADDED C52	3-5-85	N. PARKER
		Rev F DCN F-1075	5-5-85	DLR
		REV G DCN F 1104	7-17-85	BZ



QTY REQD	CODE IDENT	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION

PARTS LIST

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS ± DECIMALS .XX ± .XXX ± ANGLES ±

MATERIAL

FINISH

NEXT ASSY | USED ON

APPLICATION

DO NOT SCALE DRAWING

CONTRACT NO.

APPROVALS	DATE
DRAWN N. PARKER	12-13-84
CHECKED	

COMTEST

COMPONENT LAYOUT
A6 3100 LO. VOLT P.S. BD.

SIZE	CODE IDENT NO.	DRAWING NO.
C	4J835	0712-50-0057

SCALE 2:1 | REV. | SHEET 1 OF 1

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
		REV. D REDRAWN	7-9-86	DCN
		REV. E REVISED U8-PIN1	9.11.86	DCN

XA7

19 MARKER ON — A GAIN — TP10 — R3 10K 1% — R4 10K — R5 21K 1% — R6 56.2K 1% — R7 100K — R8 200K 1% — R1 20K — R2 10K — Q13 2N2222 — C1 12 — R9 100K, 1% — U5A TL082 — U5B TL082 — U7A DG308

H — 10DB/DIV OFFSET ADJ

A — RESET

R — VERT POS — R16 1K — R17 270 — R18 100K — U24 607

P — VERT IN — TP9 — R32 1M — U7D DG308

S — VERT GAIN — R48 330 — R49 11K — R33 51K — R34 50K VERT GAIN — R35 10K 1% — R36 10K 1% — U6A TL082 — U6B TL082

21 — RCV/DPLX

10, L — AUDIO FILTER — TP1 — C24 .082 µf — R71 14.3K 1% — SUBTONE — U2 741 — C25 .022µf — R72 182K 1% — R73 511K 1% — R74 105K 1% — R75 52.3K 1% — C26 .0012 µf — C27 120 — C37 150 — C38 .0047 µf — R76 866K 1% — C28 .0012µf — C29 .012 µf — C30 .0027 — C31 .0027µf — U1 741 — R77 191K 1% — R78 348K 1% — R79 237K 1% — R80 140K, 1% — R81 69.8K, 1% — C32 330 — C33 390 — C39 220 — C40 .0027µf — C41 .0047µf — R82 357K 1% — R83 80.6K, 1%

T — MOD

17 — MTR IN — C43 .01 µf — R90 270K — U12 CA3140 — R91 1K — R93 2K — R94 560K — U11A 74LS32 — U13D 74LS00

2 — U25 4030

1 — Z MOD — R109 10K — C54 82 — 1,2,5,6, 7, 12, 13 — U11B 74LS32

9, K — L2 2½T — C34 1µf — C35 .01 µf — C36 100µf

8, J — L1 2½T — C55 1µf — C56 .01 µf — C57 100µf

U14 74LS76 — R110 470 — C58 2.2

U13C 74LS00 — U23B 74LS08 — U23C 74LS08 — U13A 74LS00

HOLD OFF — TP8 — U14 74LS76 — CR6 IN914 — R95 1K — R112 1K — R113 47K — C60 10µf — CR14 IN914 — CR7 IN914 — U15 74123 — AUTO RESET

U11D 74LS132

U26 H11F1 — Q19 2N2222 — R111 150

U27 TL081 — R121 47K

P1 — VERT + — VERT − — HV GRD — BLANK — HORZ − — HORZ + — P1

+200V — C2 .22µf 250V — R10 15K — C12 .22µf 250V — R23 100K — C13 .22µf 250V — R26 180K — R24 18K — C14 .01 — Q1 2N 6556 — R27 51 — R25 390K — CR3 IN5267A — CR2 IN4004 — CR4 IN4004 — CR1 IN 5239 — R41 2.2K — C22 .0027µf — Q2 2N6557

+200 — R21 68K — Q5 2N6557 — R22 68K — Q6 2N6557 — C21 1µf — R39 10K — VERT BIAS — R40 5.6 K — Q4 2N 6557 — R37 3.3K — R38 470 — R51 68K — Q3 2N6557 — R50 3.3K — R52 68K — TP4 — TP3 — TP2

HORZ AMP — Q9 2N 6557 — Q11 2N 6557 — Q10 2N6557 — Q12 2N6557 — R11 68K — R12 68K — R28 150K — R29 150K — R44 9.1K — R45 9.1K — TP6 — TP5

MARKER CALIB — R42 100K — R43 100K — R56 100K — R53 10K — R57 1.2K — R54 47K — R55 1K — CR10 IN914 — CR5 IN914 — C59 1µf MONO — U9A TL082 — U7C DG 308

Q8 2N3565 — CR9 IN914 — R60 6.19K 1% — R59 24.9K 1% — R61 1K — Q7 2N4121 — C15 12 — R62 22K — C16 .1µf — CR8 IN914 — R63 10K — R64 270 — R65 39K — R66 10K — U98 TL082 — U10 607 — R122 10 — R123 20K — R67 2K — R68 1K — R69 8.2K — U18A 74C32 — U23A 74LS08

U8 74123 — C53 4.7 — R85 36K — C42 .01µf — CR15 IN914 — U11C 74LS32 — R58 4.7K — R84 10K — R89 10K — R86 1.8K — Q17 2N2222 — R87 10K — R88 10K — Q18 2N 4121

R70 39K — C6 .01 µf — U15 74123

U3 LM380 — R30 10 — C3 100µf — C4 470 — C5 10 µf — C8 .01 — C7 1µf — R31 2.7 — R124 1Ω ½W — R125 1Ω ½W — C61 1µf — R46 4.7K — R47 56K — R126 1K — C9 .1µf — C10 .01µf — L3 .68 2½T — C17 100 µf — C18 .01 µf — C19 .01µf

UNREG +15 — 6, F
SPKR — 5, E
VOL — 7
ALARM — 3
RTN — 4, D
HORZ POS — Z
+5 — 11, M
GND — 12, N
LISS/EXT — 15
EXT HORZ — 16
LISSAJOUS — 20
HORZ GAIN — 18
SCAN — 8
Y — 10
X — 1
W — .1
V — .01
SA SWP — C

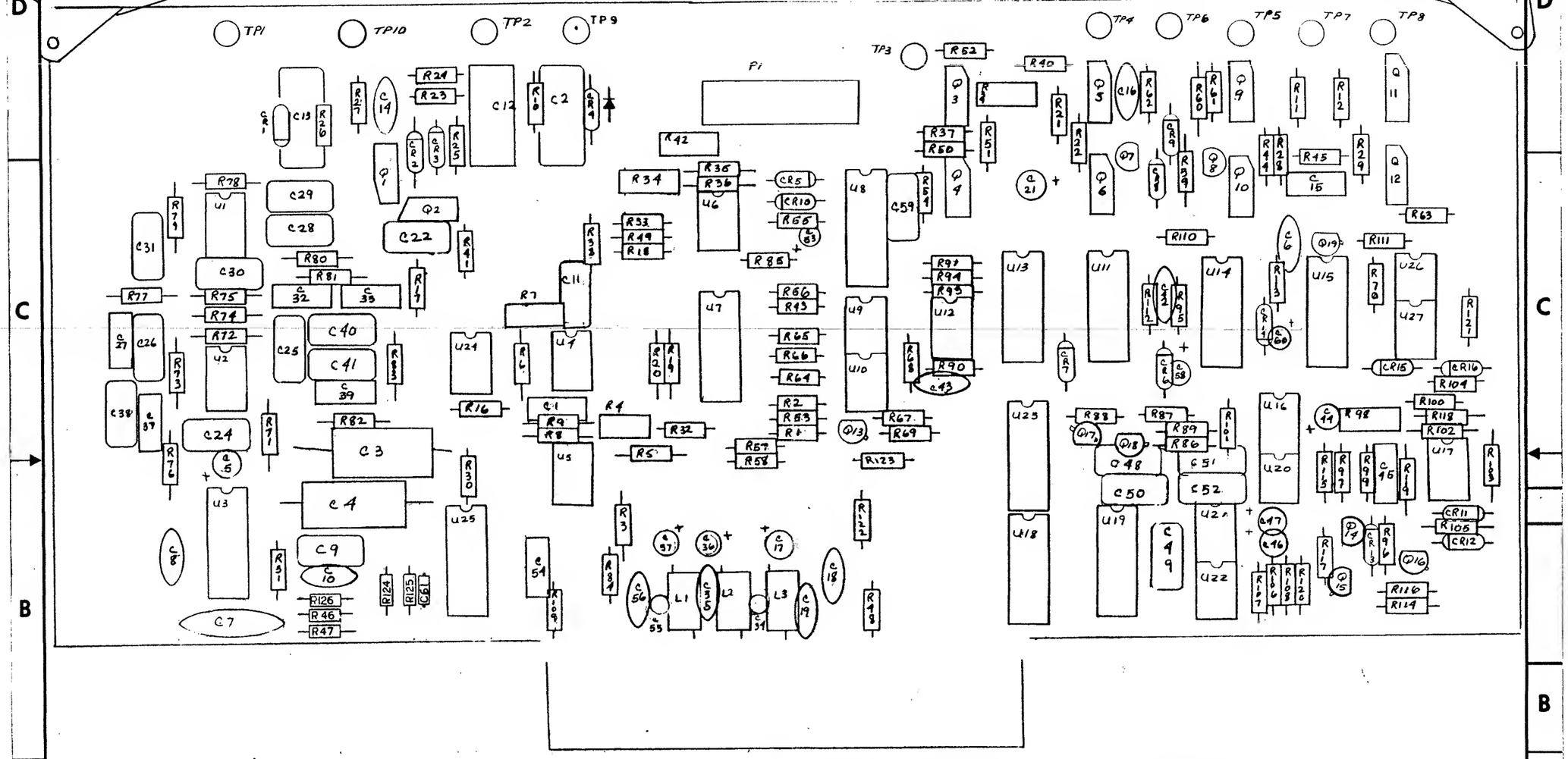
U18C 74C32 — U18D 74C32 — U18B 74C32 — U21 607 — U22 607 — R106 270 — R107 1K — R108 270 — C46 4.7µf — C47 .47 µf — C51 .047µf — C52 .0047 µf — R120 1K — U16 607 — U20 607 — R100 270 — R101 270 — R102 15K 1% — R119 10K, 1% — C45 .10 — U17A TL082 — U17B TL082 — R103 6.19K 1% — R104 2.2K — CR16 IN914 — CR11 — CR12 — IN914 (2X) — R105 10K 1% — TP7 — R96 2.7K — CR13 IN914 — R97 12K — Q14 2N4121 — R99 3.9K — R98 5K SWEEP — Q15 PN4275 — R114 1K — R115 1K — C44 3.3 µf — R117 1K — R118 30.1 K 1% — Q16 PN4275 — R116 1K — U19 DS308 — C48 .22 µf — C49 .022 µf — C50 .0022 µf

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS±1/64 DECIMALS .XX ± .01 .XXX ± .005 ANGLES ±1°	CONTRACT NO		
	APPROVALS	DATE	COMTEST SYSTEMS, INC.
	DRAWN D. NOELLER	7-9-86	A7 DEFLECTION BD. 3100
MATERIAL	CHECKED		
FINISH	RELEASED		SIZE D — CODE IDENT NO 4J835 — DRAWING NO 0714-30-0050
NEXT ASSY / USED ON / APPLICATION	DO NOT SCALE DRAWING		SCALE — SHEET 1 OF 1

THIS DOCUMENT CONTAINS INFORMATION PROPRIETARY TO COMTEST SYSTEMS, INC. AND IS NOT TO BE REPRODUCED OR USED IN ANY MANNER WHATSOEVER WITHOUT THE EXPRESS WRITTEN APPROVAL OF COMTEST SYSTEMS, INC.

ARBAUGH

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
		REV A DCN F-1010	6-25-84	DLR
4		REV B DCN F-1029	12-7-84	N.P.
		REV C DCN F-1101	8-5-85	BN



QTY REQD	CODE IDENT	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION

PARTS LIST

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS ± DECIMALS .XX ± .XXX ± ANGLES ±

MATERIAL

FINISH

DO NOT SCALE DRAWING

CONTRACT NO.

APPROVALS	DATE
DRAWN ROSE	12-1-83
CHECKED	

COMTEST

A7 DEFL. BD 3100

SIZE	CODE IDENT NO.	DRAWING NO.
C	4J835	0712-50-0050

SCALE

SHEET 1 OF 3

NEXT ASSY	USED ON

APPLICATION

MARSAUGH

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
		REV. D REDRAWN	3-15-86	DCN

P/O XA8
9, K → +15V
8, J → -15V
10, L
2, B
1, A

P/O J1
BLU/WHT → 1
GRN/WHT → 2
RED/WHT → 3
VIO/WHT → 4
GRN → 6
BLU → 5

R2 43K
R1 43K
CR2 IN4006
CR1 IN4006
CR4 IN4006
CR3 IN4006
C5 120µf
R11 820 1/2W
R10 22K 2W
Q1 2N6559
Q2 2N6559
Q3 2N6559
R27 18
CR8 IN914
C12 220
R30 2.2K
U1 741
R34 19.6K 1%
R33 19.6K 1%
C13 10µf
R28 255K 1%
R29 10K 1%
CR7 IN4006
TP1
R6 180K
R3 100K ASTIG
R5 180K
C14 .05µf
R36 221K 1%
R35 2.8K 1%
C3 .01µf
200V → 11 → P/O J2 RED
HV GND → 10 → BLK
G2 → 12 → BLK
+15V
+5V
R43 4.7K
U2A LM339
R38 11K 1%
R37 10K 1%
C15 .05µf
U2B LM339
R40 11K 1%
R39 10K 1%
C16 .05µf
R4 10K HV
R7 20K
R9 4.87K
C2 .05µf
U2D LM339
R45 8.45K 1%
R44 10.2K 1%
C18 .05µf
U2C LM339
R42 11.8K 1%
R41 10.2K 1%
C17 .05µf
+5 → 11, M → P/O XA8
HV FAULT → 12

CR11 G7F
CR10 G7F
CR9 G7F
CR12 G7F
HV+
HV- C9 .25µf
C10 .01µf
R31 4.7M
R49 4.7M
R32 33K
Q4 2N6559
CR16 NV430D10
CR15 IN914
C19 .0047µf
R47 10K
R48 120
U3 741
CR14 IN914
CR13 IN914
R46 2.2K

R22 1M
R23 1M
R24 1M
R25 1M
R26 1M
C7 .01µf
C8 .01µf
C1 .01µf
R12 169K 1%
R13 19.6K 1%
R14 392K 1%
R15 301K 1%
R16 261K 1%
R17 261K 1%
R18 261K 1%
R19 261K 1%
R20 261K 1%
R21 261K 1%
TP2
C11 .25µf

K → 4 → P/O J2 VIO
BLANK → 9 → WHT
G → 8 → BRN
C4 .01µf
C6 .22µf
CR6 G7F
R8 22M
INT → 7 → BRN
INT 1 → 3 → WHT
FOC 2 → 5 → VIO
FOC 1 → 6 → GRN
FIL → 2 → YEL
FIL → 1 → GRY

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ARE: FRACTIONS±1/64 DECIMALS ANGLES XX ± .01 ±30' XXX ± .005	CONTRACT NO.	COMTEST SYSTEMS, INC.		
MATERIAL	APPROVALS / DRAWN D. NOELLER	DATE 3-15-86	A8 HI VOLT POW. SUPPLY 3100	
FINISH	CHECKED		SIZE D	CODE IDENT NO. 4J835
NEXT ASSY / USED ON / APPLICATION	RELEASED		DRAWING NO 0714-30-0068	
DO NOT SCALE DRAWING	THIS DOCUMENT CONTAINS INFORMATION PROPRIETARY TO COMTEST SYSTEMS, INC. AND IS LOANED SUBJECT TO THE AGREEMENT THAT IT WILL NOT BE REPRODUCED OR USED IN WHOLE OR PART WITHOUT THE PRIOR APPROVAL IN WRITING OF COMTEST.		SCALE	SHEET 1 OF 2

MARSHALL

REV	ECN	BY	DATE	APP
C	DCN F-1099	BN	7-85	BN
D	UPDATED	DCN	7-86	DCN

OPTION PSOF

U9A TL082 · R88 18.2K 1% · R89 18.2K 1% · C35 .01µf · U9B TL082 · C36 62 · C37 .001µf · R59 1K · R60 500 PSOF · R57 1.1K 1% · R58 18K · C22 .0039µf · C21 .0068µf · R76 19.6K 1% · U6C TL084 · R75 5.9K 1% · C23 .1µf · R73 5.9K 1% · R74 5.62K 1% · C20 560 · U6D TL084 · R84 4.53K 1% · R83 100 1% · C29 047µf · C28 047µf · C27 022µf · R85 26.1K 1% · U6A TL084 · C30 022µf · C31 .022µf · R79 5.62 1% · R86 78.7K 1% · C24 .022µf · R80 28K 1% · U6B TL084 · TP4

U10 DG308A · +5V · R62 22K · U4A 74C04 · P/O XA8 R-> · PSOF JUMPER · C25 .05µf · R77 1M · U5A TL084 · R67 45.3K 1% · R66 9.76K 1% · C26 10µf · C32 1µF · U7 AD 636 · R69 12.1K 1% · R53 5K RMS · R70 7.32K 1% · U5D TL084 · U8 · U4D 74C04 · R54 100K OFFSET · R51 10K · R60 30.1K 1% · 0dB · R61 261K · C33 1000 · R81 * · dB GAIN · R52 500 · U5B TL084 · R68 36K · CR19 IN914 · U8 DG 308A · U5C TL084 · TP6 · R72 2K · R56 1K · MTR. ADJ. · METER OUT · P/O XA8 X.

SINAD W · MOD. 19 · 9,K · 8,J · 11,M · MTR RTN 20 · TP5 · 10,L · C41 100µf · C40 100µf · C42 100µf

V -> · TP3 · C38 .05µf · R92 1M · U11 LF357 · R91 47K · R90 1K · PEAK R55 5K · C39 15µf · CR18 HS1001 · R93 2K · CR17 HS1001 · C34 2.2µf · R87 215K · R71 261K 1/4W 1% · R82 523K* 1% · R78 274K 1% · U8 · U4C 74C04

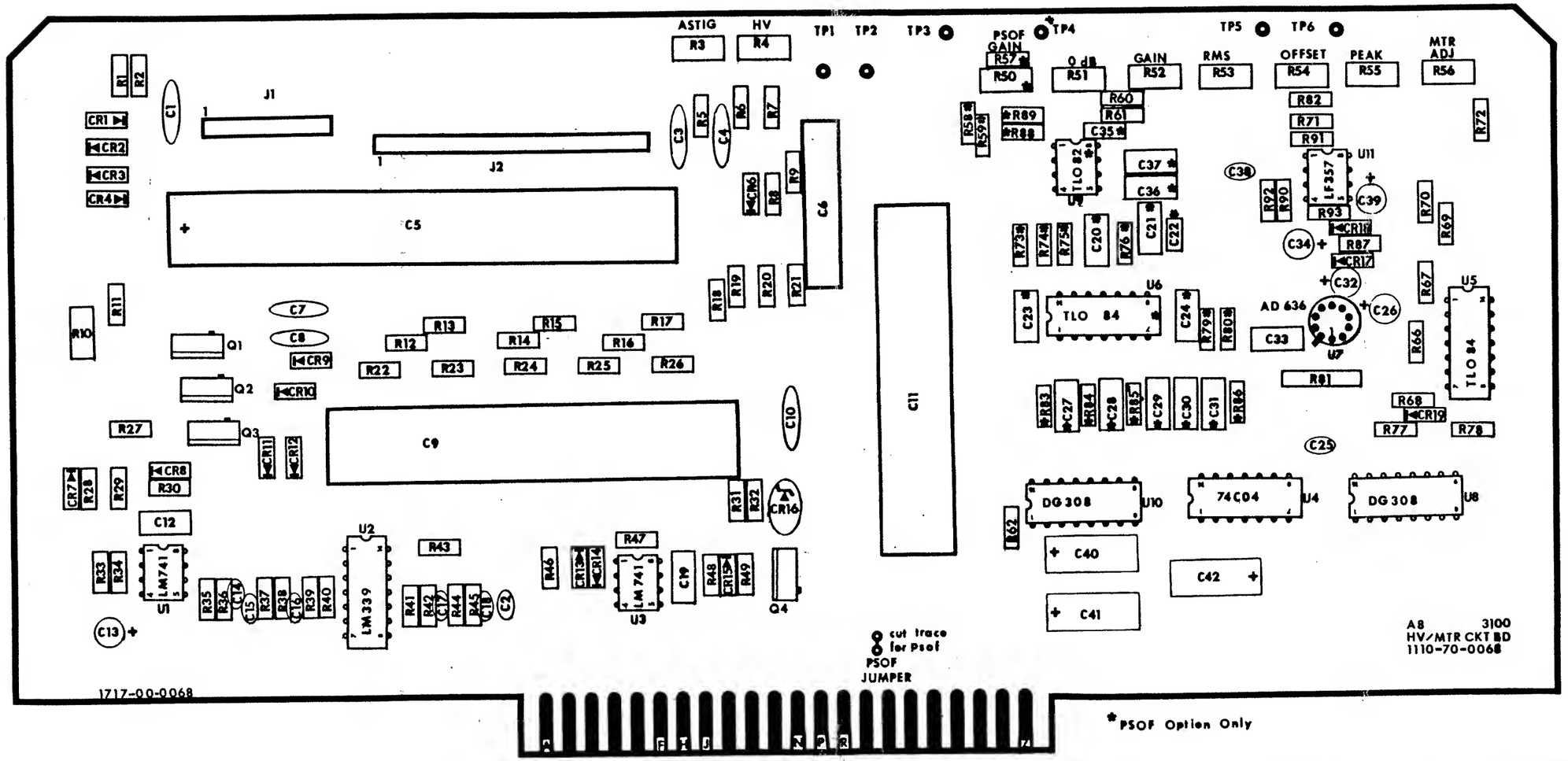
18 WATTS SELECT · U4B 74C04 · U10 · U10 DG308 · TP7

17 WATTS IN · 16 METER OUT

*SPECIAL RESISTOR

NOTE: UNLESS OTHERWISE SPECIFIED

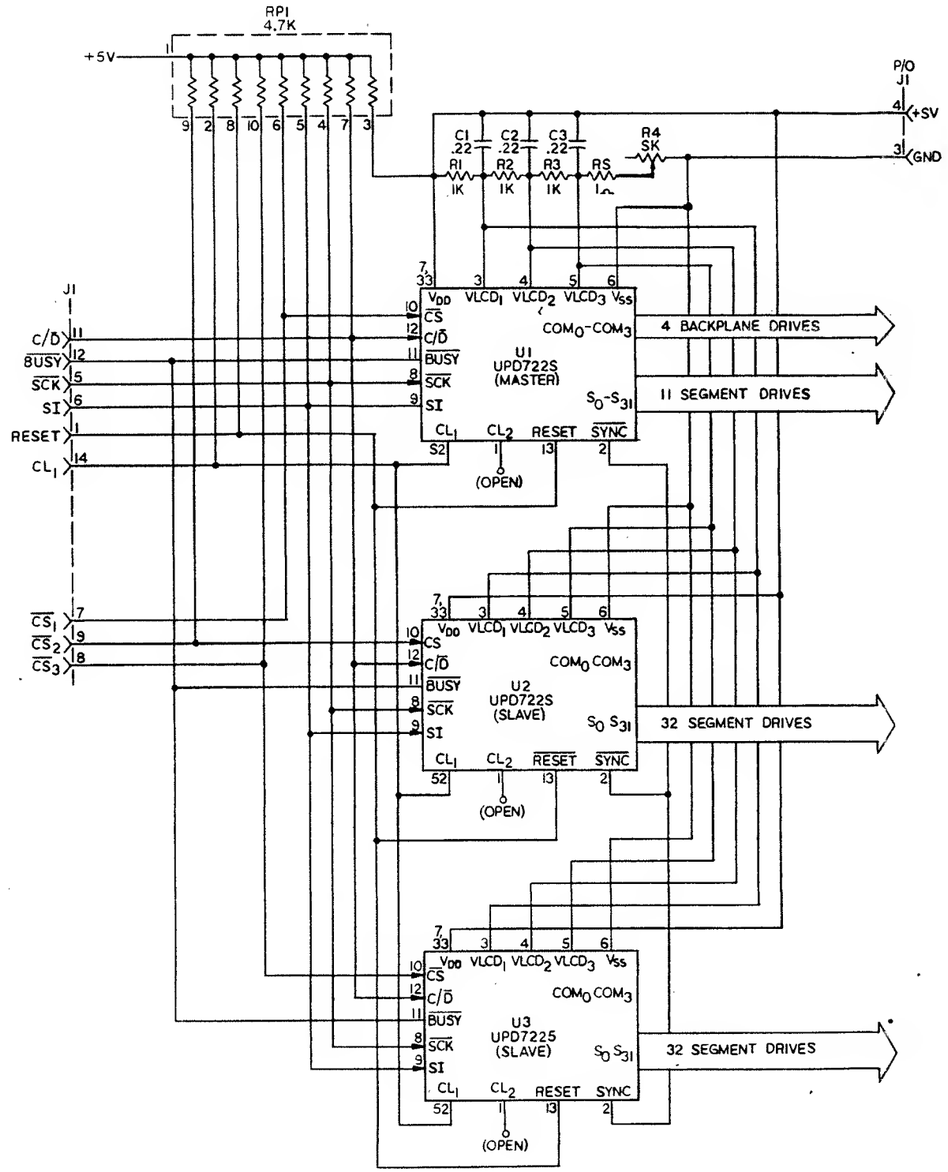
REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN B.NAYLOR	DATE 6-85	COMTEST SYSTEMS, INC.
MATERIAL	PROJ ENGR		TITLE: A8 METER CKT 3100
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX XX ANGLES		
	DO NOT SCALE DWG		MODEL NO. · DWG NO. 0714-30-0068 · REV
	SCALE		CODE IDENT 4J835 · SHEET 2 OF 2



*PSOF Option Only

REVISIONS			REVISIONS			COMTEST		
	ECN'S	BY		ECN'S	BY			
F			A	F-1073	ALC	A8 HV/MTR CKT ASSEMBLY DRAWING		
G			B	F-1099	DLR			
H			C			DRAWN BY	DATE	NUMBER
I			D				5-24-85	0712-50-0068
J			E			APP'D		

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
		REV. B REDRAWN	3-27-86	DCN



LCD PINOUT

PIN	DESIG	TO	PIN	DESIG	TO
1	COM 2	U1-17	52		
2	S1	U3-20	S3	COM 1	U1-15
3	S3	U3-22	54	NC	
4	SØ	U3-19	SS	S11	U1-30
S	S2	U3-21	S6	NC	
6	S7	U3-26	57	S30	U2-50
7	S4	U3-23	S8	S28	U2-48
8	S6	U3-25	S9	S31	U2-S1
9	S9	U3-28	60	S29	U2-49
10	S11	U3-30	61	S26	U2-46
11	S8	U3-27	62	S24	U2-44
12	S10	U3-29	63	S27	U2-47
13	S13	U3-32	64	S2S	U2-4S
14	S1S	U3-3S	6S	S22	U2-42
15	S12	U3-31	66	S20	U2-40
16	S14	U3-34	67	S23	U2-43
17	S19	U3-39	68	S21	U2-41
18	S16	U3-36	69	S18	U2-38
19	S18	U3-38	70	S16	U2-36
20	S21	U3-41	71	S19	U2-39
21	S23	U3-43	72	S17	U2-37
22	S20	U3-40	73	S14	U2-34
23	S22	U3-42	74	S12	U2-31
24	S25	U3-4S	75	S1S	U2-3S
2S	S27	U3-47	76	S13	U2-32
26	S24	U3-44	77	S10	U2-29
27	S26	U3-46	78	S8	U2-27
28	S29	U3-49	79	S11	U2-30
29	S31	U3-51	80	S9	U2-28
30	S28	U3-48	81	S6	U2-2S
31	S30	U3-S0	82	S4	U2-23
32	S10	U1-29	83	S7	U2-26
33	S1	U1-20	84	SS	U2-24
34	SØ	U1-19	85	S2	U2-21
3S	NC		86	SØ	U2-19
36	S3	U1-22	87	S3	U2-22
37	S2	U1-21	88	SI	U2-20
38	NC		89	NC	
39	S5	U1-24	90	NC	
40	S4	U1-23	91	NC	
41	NC		92	NC	
42	S7	U1-26	93	NC	
43	S6	U1-25	94	S30	U3-50
44	NC		9S	SI7	U3-37
45	S8	U1-27	96	S5	U3-24
46	S9	U1-28	97	NC	
47	NC		98	COM Ø	U1-15
48	NC		99	NC	
49	NC		100	COM 1	U1-16
50	COM 3	U1-18			
51	COM 2	U1-17			

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS±1/64 DECIMALS .XX ± .01 .XXX ± .005 ANGLES ± 30'
MATERIAL
FINISH
NEXT ASSY | USED ON
APPLICATION
DO NOT SCALE DRAWING

CONTRACT NO

APPROVALS	DATE
DRAWN D NOELLER	3-27-86
CHECKED	
RELEASED	

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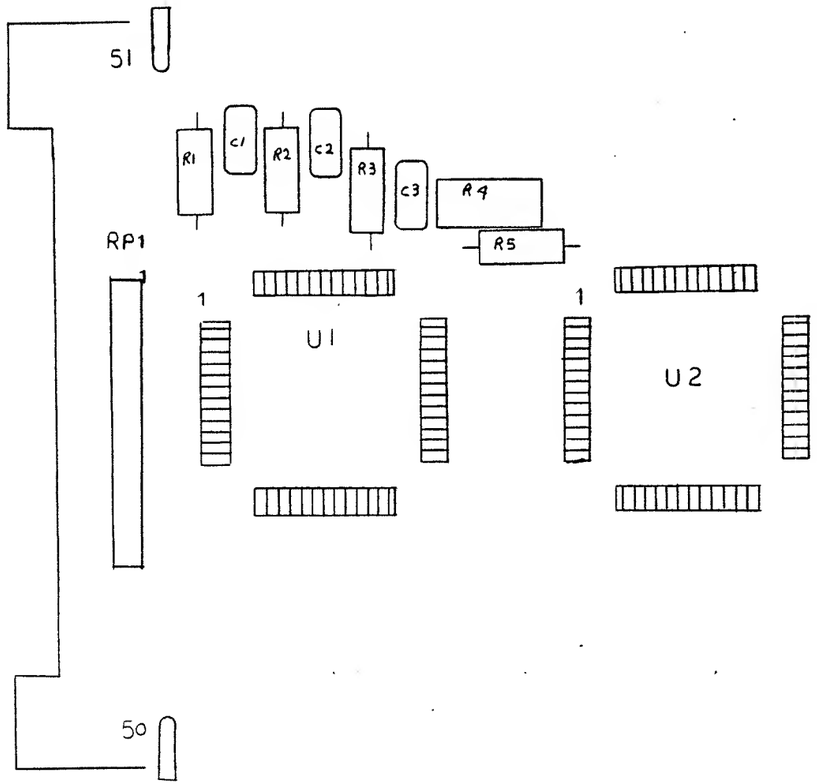
COMTEST SYSTEMS, INC.

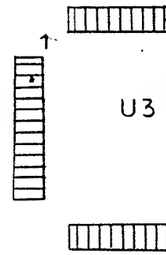
A9
LCD BD
3100

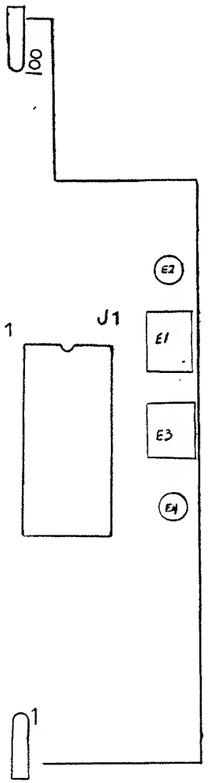
SIZE	CODE IDENT NO.	DRAWING NO.
D	4J835	0714-30-0051

SCALE x | SHEET 1 OF 1

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
		ERN F-0007		
	A	DCN F-1059 REMOVE RT-1	3-27-85	
	B	DCN F-1092	7-17-85	







QTY REQD	CODE IDENT	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
		PARTS LIST	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS ± DECIMALS .XX ± .XXX ± ANGLES ±

MATERIAL

FINISH

DO NOT SCALE DRAWING

CONTRACT NO.

APPROVALS	DATE
DRAWN RB	3-20-84
CHECKED	

NEXT ASSY | USED ON
APPLICATION

COMTEST

A9 LCD BD. 3100

SIZE	CODE IDENT NO.	DRAWING NO.
D	4J835	0712-50-0051

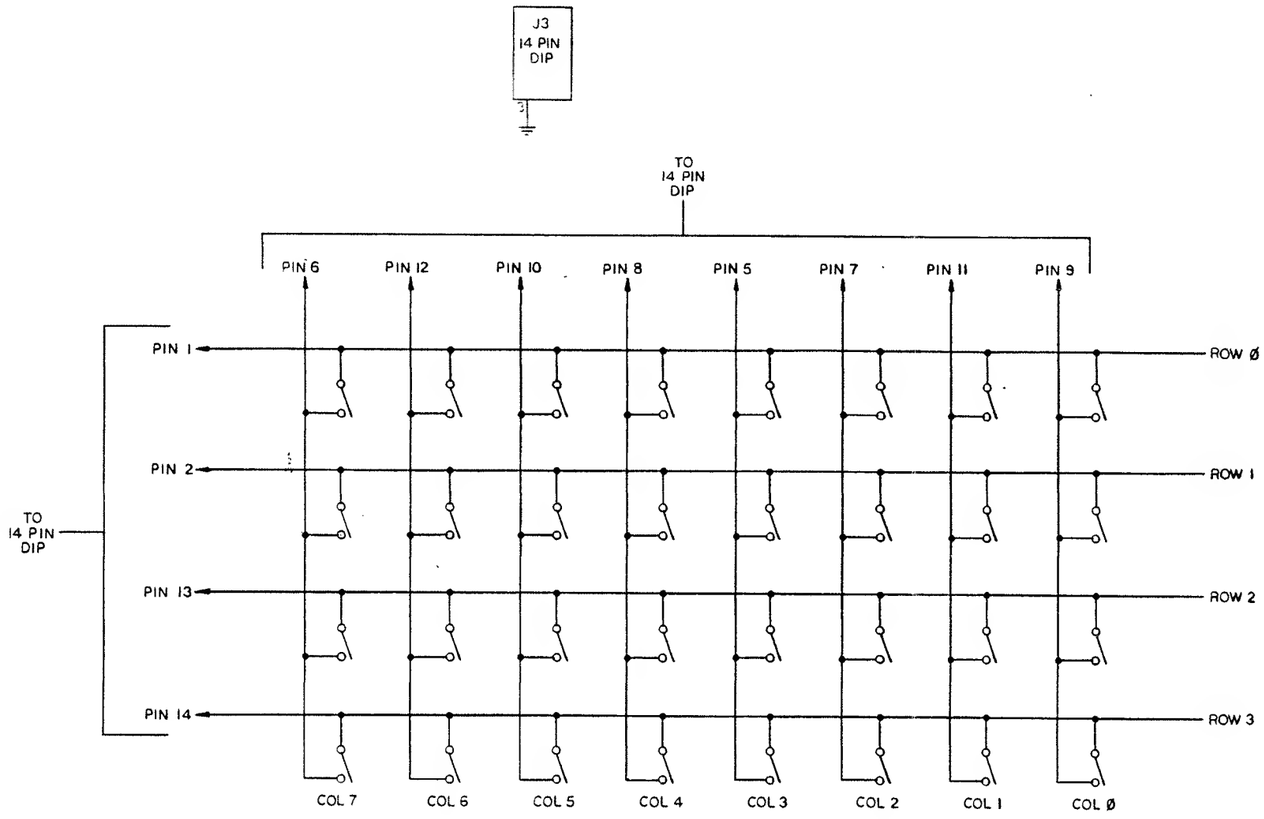
SCALE | SHEET 1 OF 1

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
		REV. C REDRAWN	4-22-86	DCN

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ARE: FRACTIONS±1/64, DECIMALS .XX ±.01, .XXX ±.005, ANGLES ±30	CONTRACT NO		COMTEST SYSTEMS, INC.	
MATERIAL	APPROVALS	DATE	A10 FRONT PANEL 3100	
FINISH	DRAWN D. NOELLER	4-22-86		
NEXT ASSY / USED ON / APPLICATION	CHECKED		SIZE D	CODE IDENT NO 4J835
DO NOT SCALE DRAWING	RELEASED		SCALE	DRAWING NO 0714-30-0061
	THIS DOCUMENT CONTAINS INFORMATION PROPRIETARY TO THE COMPANY. THE INFORMATION IN THIS DOCUMENT IS NOT TO BE DISCLOSED OUTSIDE THE COMPANY WITHOUT THE PRIOR APPROVAL IN WRITING OF MANAGER.			SHEET 1 OF 2

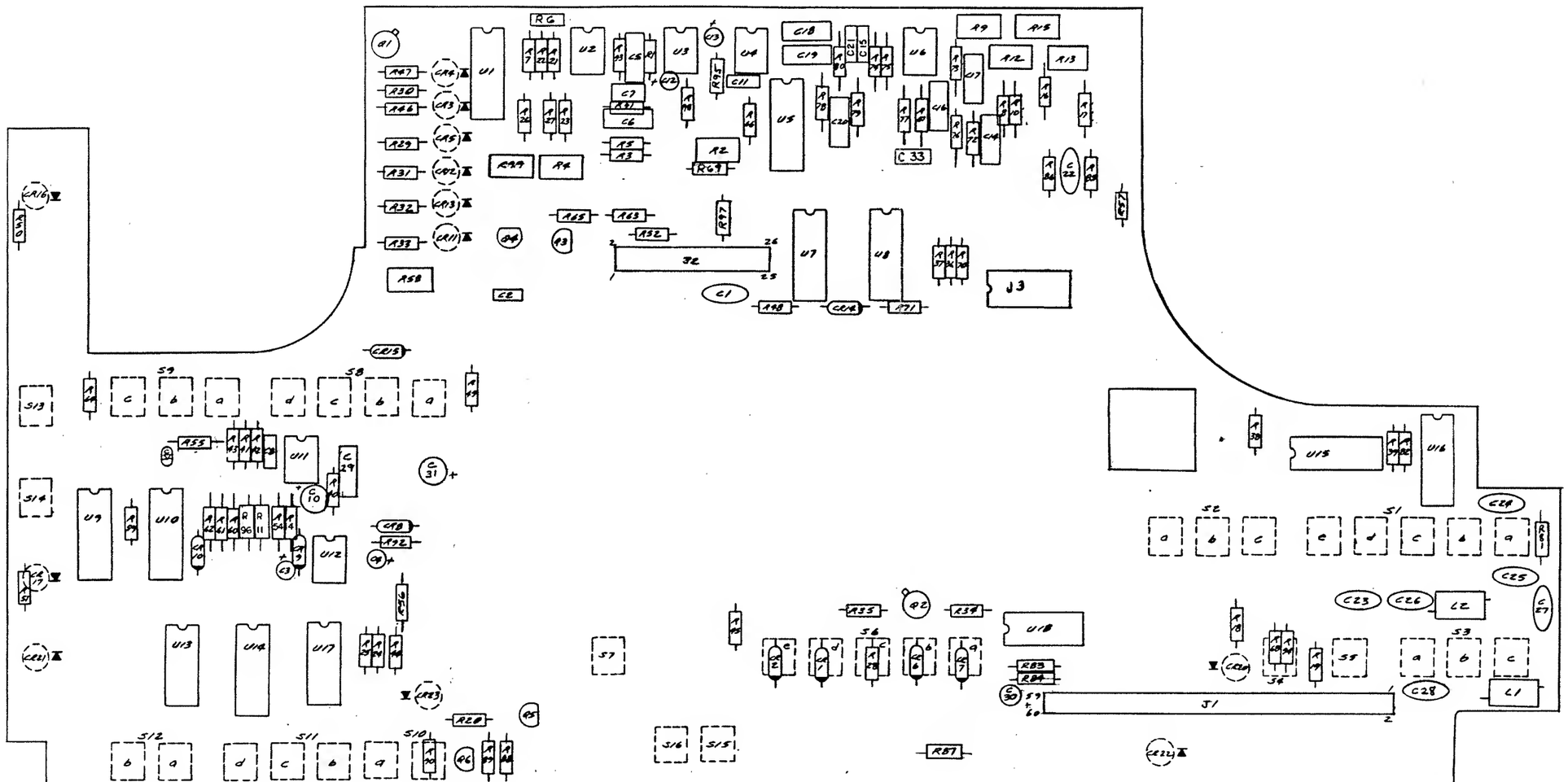
MARBAUGH

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
		REV. A REDRAWN	4-10-86	DCN



		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS/DECIMALS ANGLES ± 1/64 XX ± .01 XXX ± .005 ± 30	CONTRACT NO	COMTEST SYSTEMS, INC.	
		MATERIAL	APPROVALS / DATE: DRAWN D. NOELLER 4-14-86; CHECKED; RELEASED	A10 FRONT PANEL 3100	
		FINISH		SIZE D; CODE IDENT NO 4J835; DRAWING NO 0714-30-0061	
NEXT ASSY	USED ON	DO NOT SCALE DRAWING	THIS DOCUMENT CONTAINS PROPRIETARY INFORMATION OF COMTEST SYSTEMS, INC. THIS DOCUMENT IS NOT TO BE USED OR DUPLICATED IN ANY MANNER WITHOUT PRIOR APPROVAL IN WRITING OF COMTEST.	SCALE	SHEET 2 OF 2
APPLICATION					

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
		REV 1 DCN F-1015	11-30-84	
		REV 2 DCN F-1032	12-3-84	
		– ERN F-0006		
		REV A DCN F-1074	5-7-85	
	B	DCN F-1095	7-18-85	BN



QTY REQD	CODE IDENT	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
		PARTS LIST	

NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS ± DECIMALS .XX ± .XXX ± ANGLES ±

MATERIAL

FINISH

DO NOT SCALE DRAWING

CONTRACT NO.	
APPROVALS	DATE
DRAWN E.E.	12/31/84
CHECKED	
M. 3-14-84	

COMTEST

A10 ASSEMBLY
SWITCH BD 3100

SIZE	CODE IDENT NO.	DRAWING NO.
D	4J835	0712-50-0061

SCALE 1/1 SHEET 1 OF

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
		REV. E REDRAWN	4-19-86	DCN

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS±DECIMALS ANGLES ±1/64 XX ± .05 XXX ± .005	CONTRACT NO.
MATERIAL	APPROVALS / DATE
FINISH	DRAWN D. MOELLER 4-19-86
NEXT ASSY / USED ON	CHECKED
APPLICATION	RELEASED
DO NOT SCALE DRAWING	THIS DOCUMENT CONTAINS INFORMATION PROPRIETARY TO COMTEST SYSTEMS, INC. AND SHALL NOT BE REPRODUCED OR DISCLOSED TO OTHERS OR USED ON OR FOR ANY DOCUMENT WITHOUT THE PRIOR APPROVAL IN WRITING OF MANUFR.

COMTEST SYSTEMS, INC.

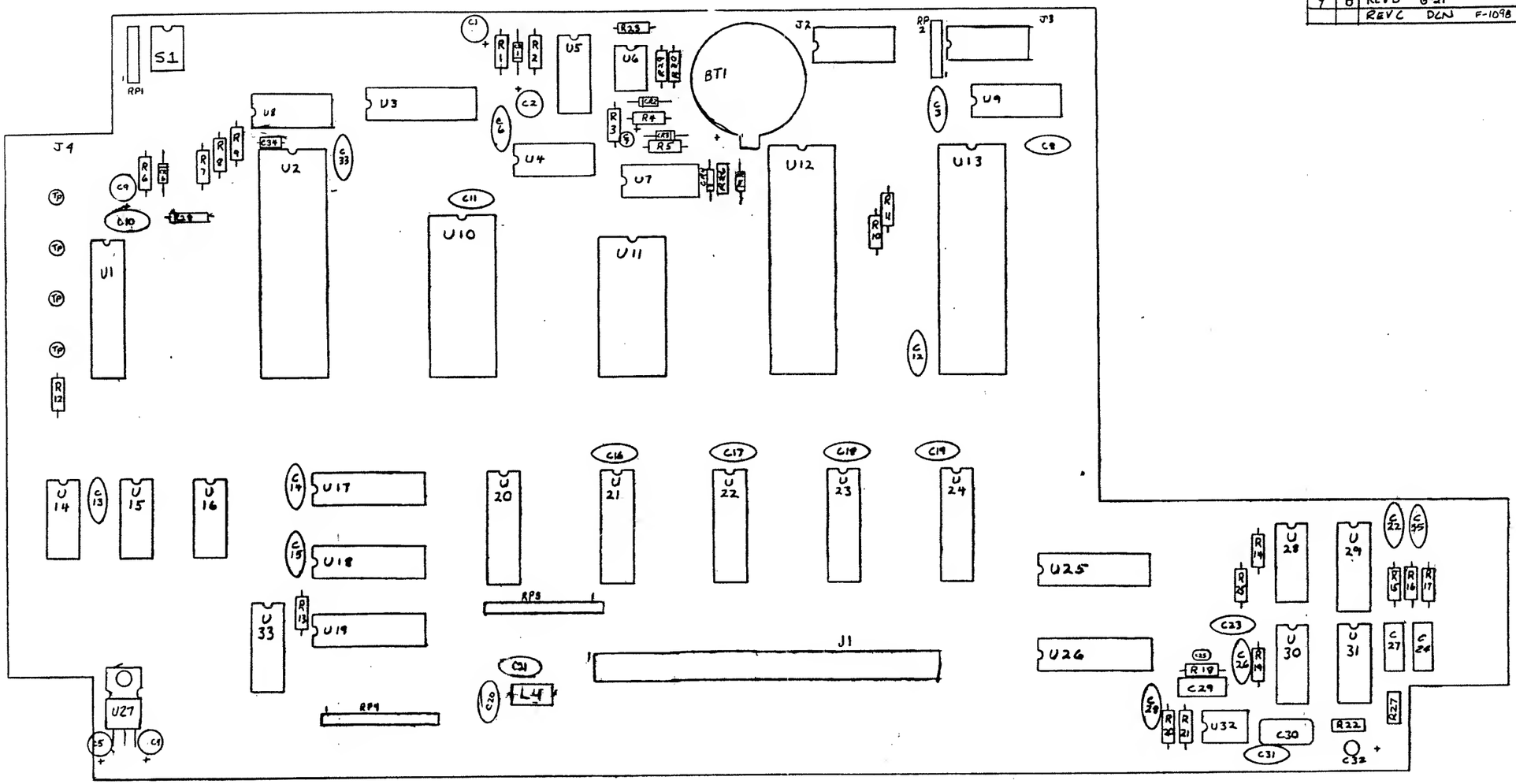
A11 PROCESSOR BD 3100

SIZE	CODE IDENT NO.	DRAWING NO.
D	4J835	0714-30-0067

SCALE — SHEET 1 OF 1

HARBAUGH

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
		REV-1	3-1-83	
		REV-2	1-6-84	
		ECN 073	2-27-84	ML
		REV A DCN F-1016	7-13-84	MR
4	B	REV B G-21	12-5-84	NP
		REV C DCN F-1098	7-18-85	BN



QTY REQD	CODE IDENT	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
			PARTS LIST

NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS ± DECIMALS .XX ± .XXX ± ANGLES ±

MATERIAL

FINISH

DO NOT SCALE DRAWING

CONTRACT NO.

APPROVALS	DATE
DRAWN ML	3-1-83
CHECKED	

COMTEST

A11 PROCESSOR BD 3100

SIZE	CODE IDENT NO.	DRAWING NO.
D	4J835	0712-50-0067

SCALE

SHEET 1 OF 3

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
		REV. B REDRAWN	4-7-86	DCN

XP1 (TO AII CPU) — XP2 (TO AIO) — J1 (TO FP)

TO CPU · TO AIO · TO FRONT PANEL

E140 CELL/MTR · E9 LCD · E8 LCD · E7 PSOF · E13 PSOF GND · E3 SPR RTN · E4 SPR RTN · E5 10MHZ · E6 MIC · E1 · E10

A8 · A7 · A6 · A5 · A4 · A3 · A2 · A1

800KHZ · 3.2MHZ

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS±1/64 DECIMALS .XX ±.01 .XXX ±.005 ANGLES ±1°	CONTRACT NO.	COMTEST SYSTEMS, INC.			
MATERIAL	APPROVALS	DATE	A13 MOTHER BOARD 3100		
FINISH	DRAWN D. NOELLER	4-7-86	SIZE D	CODE IDENT NO. 4J835	DRAWING NO. 0714-30-0070
NEXT ASSY	USED ON	CHECKED			
APPLICATION	DO NOT SCALE DRAWING	RELEASED	SCALE		SHEET 1 OF 2

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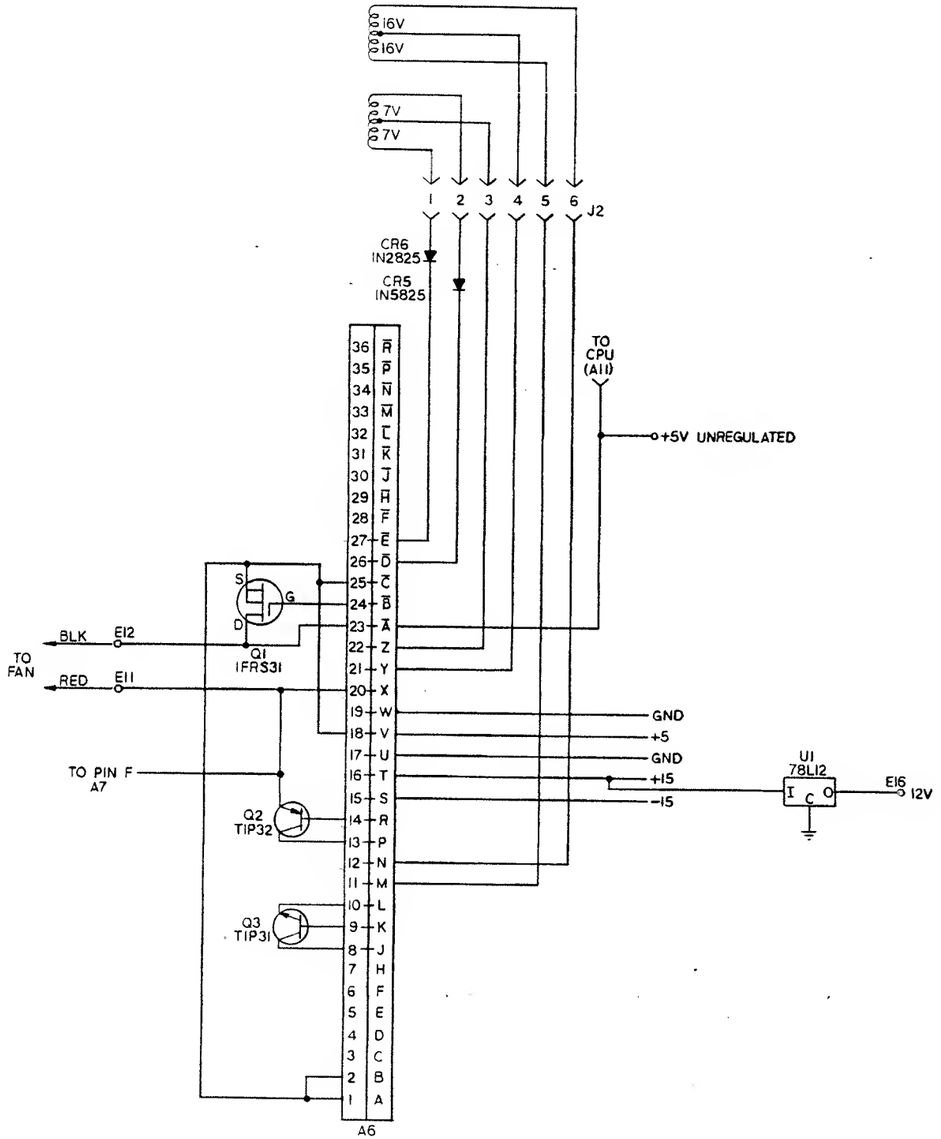
MARBAUGH

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
		REV. C REDRAWN	4-10-86	DCN



J1

PIN	OESG	TO
1	GNO	
2	VOL	A7-7
3	HORZ POS	A7-2
4	HORZ GAIN	A7-18
5	+15	BUSS
6	NC	
7	NC	
8	+5	BUSS
9	1KHZ	A5-17
10	LVL ADJ	R5
11	OC CONTROL	A4-2
12	LVL OUT	A5-4
13	SA GND	A3-4
14	SA SWP	A7-C
15	NC	
16	SQ+	R4
17	SQUELCH	A2-3
18	SQ-	R3
19	MTR RTN	A8-20
20	-Y	R2
21	VERT POS	A7-R
22	+Y	R1
23	VERT GAIN	A7-S
24	VERT IN	A7-P
25	MTR LAMP	A6-23
26	GND	

PIN	DESG	TO
1	+5 UNREG	A6-23
2	+5 UNREG	A6-23
3	UNLK 3	A3-B
4	±15 FAULT	A6-31
5	UNLK 1	A1-5
6	HV FAULT	A8-12
7	UNLK 4	A4-S
8	BURST	XP2-55
9	LVL 3	A3-F
10	CONT	XP2-18
11	LVL 1	A1-7
12	NC	
13	IMAGE	XP2-51
14	NC	
15	LO BATT	E2 INVERTR
16	SCAN	A7-8
17	BUSY	A5-X
18	NC	
19	B1	A3-Z
20	GND	
21	B3	A3-Y
22	SUBTONE	A7-U
23	B5	A3-X
24	OPL	XP2-59
25	B4	A3-21
26	NC	
27	B6	A3-20, A6-0
28	NC	
29	DPLC	XP2-56
30	NC	
31	B7	A3-22
32	NC	
33	F100	A5-2
34	NC	
35	F400	A5-6
36	NC	
37	NC	
38	NC	
39	F1000	NC
40	+15	BUSS
41	F200	A5-7
42	NC	
43	NOT USED	XP2-60
44	NC	
45	GEN	XP2-52
46	NC	
47	F800	A5-5
48	-15	BUSS
49	MOD	A7-T
50	NC	
51	IF	A2-17
52	RCV, DUPLEX	A2-2, XP2-24
53	DATA	A1-14, A3-14, A4-14, A5-Y
54	SCLK 1	A1-R, A3-R, A4-R
55	SCLK 2	A5-Z
56	RESET	A5-W
57	RF ENABLE	A1-15
58	LO ENABLE	A1-13
59	A3 ENABLE	A3-15
60	A4 ENABLE	A4-15

PIN	DESG	TO
1	+5	BUSS
2	+15	BUSS
3	-15	BUSS
4	GNO	BUSS
5	PTT	E1
6	OFF	A4-1
7	DB01	A4-3
8	DB02	A4-4
9	GNO	
10	GNO	
11	DB03	A4-5
12	FM (G)	A4-6
13	NC	
14	NC	
15	100°	A4-22
16	10W	A4-Z
17	NC	
18	CONT	XP1-10
19	100W	A4-Y
20	WATTS	A4-X
21	SINAD LED	A5-T
22	SINAD	A8-W
23	MV	A4-V
24	RCV/DUPLEX	XP1-52, A2-2
25	MOD	A8-19
26	AM (G)	A5-F
27	SIG	A2-19
28	AM (R)	A2-20
29	DIST IN	A5-20
30	DIST OUT	A5-19
31	FM (R)	A2-22
32	WIOE	A2-2
33	MTR IN	A8-V, A7-17
34	SYNTH AUDIO	A5-16
35	CALIB	A2-X, A7-2
36	V-	A2-W
37	NC	
38	MTR OUT	A8-X
39	V+	A2-V
40	SSB	A2-T
41	MIC	A6-E
42	WATT/MOD	A8-18
43	AM	A2-5
44	SCAN	A2-E, A3-3, A7-8
45	.01	A7-V
46	.1	A7-W
47	DBI2	A1-4
48	DBI1	A1-5
49	1	A7-X
50	10	A7-Y
51	IMAGE	XP1-13
52	GEN	XP1-45
53	LISSAJOUS	A7-20
54	MARKER	A7-19
55	BURST	XP1-8
56	DPLC	XP1-29
57	EXT HORZ	A7-16
58	LISS/EXT	A7-15
59	OPL	XP1-24
60	NOT USED	XP1-43

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS DECIMALS ANGLES ±1/64 .XX ± .01 .XXX ± .005 ±30	CONTRACT NO	COMTEST SYSTEMS, INC.	
MATERIAL	APPROVALS / DRAWN D. NOELLER	DATE 4-10-86	A13 MOTHER BOARD 3100
FINISH	CHECKED		
NEXT ASSY / USED ON	RELEASED		SIZE D / CODE IDENT NO. 4J835 / DRAWING NO. 0714-30-0070
APPLICATION / DO NOT SCALE DRAWING	THIS DOCUMENT CONTAINS INFORMATION PROPRIETARY TO COMTEST SYSTEMS, INC. IT IS NOT TO BE USED OR DUPLICATED IN ANY MANNER WITHOUT THE PRIOR APPROVAL IN WRITING OF COMTEST		SCALE — / SHEET 2 OF 2

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED

A3 RF PLL
500KHz
4MHz FROM µP
PLL
22-.922MHz ΔF=1MHz
+7dBM
-7dBM
13dB PAD
LOCK IN ROLL
LOCK DET.
LEVEL DET
SWEEP
UNLOCK FAULT
LEVEL FAULT

A1 RCV
-3dB PAD
L.O. LVL DET.
LEVEL FAULT
1ST IF GAIN
21-22MHz BPF
PIN ATTN
SWITCHABLE LPF
60MHz
170MHz
ALL PASS
REF. LVL ATTN
0-20-40 dBm
PWR LMTR
ANT IN
FROM A10
3.9MHz
+8dBM
24.9-25.9 (RCVR RVS.)
17.1-18.1 (RCVR NOM.)
AGC
LPF
ΔF=10KHz
77.5-87.7MHz
PLL
FROM µP
238 KHz
÷256
60.9901-61.0099MHz
ΔF=100Hz
PLL
3.2MHz
800KHz
60 MHz
60MHz
.9901-1.0099MHz
LOCK DET
MIC.
UNLOCK FAULT
AUDIO

A6 PS
+15V -15V +5V
VOLT DET.
LV (+/-15V) FAULT
POWER SUPPLY
3.2MHz
PLL
÷4
800KHz
X6
3dB PAD
60MHz
TCXO (OCXO)
10MHz
AEF ÷
100KHz
200KHz
500KHz
1MHz
2MHz
4MHz
8MHz
MIC LIMITER/ FILTER
10MHz

A9 LCD BD
152.7200 MHz

A11 PROCESSOR
RAM
µP
PROM
BATTERY BACKUP
DIGITAL CODE
ENCODE
DECODE
8MHz
AUDIO
AUDIO

A10 SWITCH BD
KEYBOARD
FROM UNIT
TO UNIT
TO REAR PANEL "REMOTE INTERFACE"

A2 IF
3.2MHz
700KHz NARROW BPF
3.9MHz
700KHz
700KHz WIDE BPF
IF GAIN
DEMOD
SQUELCH CONTROL
AGC
AM
SSB
80dB
LOG AMP
ANALYZER DET/AMP
FM PLL/BFO
FM MARKERS
AM/SSB
FM
VIDEO
100KHz
IF
FREQ. ERROR

A5 AUDIO
FROM µP
AUDIO
PROM
RF LVL
DC
AM RF LVL
AUDIO µP
DTMF GEN
METER IN
AUDIO SYNT
200KHz
÷200
1KHz
DEMOD
NOTCH FILTER
SINAD

A8 HI VOLT PS
VOLT DET.
HV FAULT
HV PS
-1266V
DEFL PS
200V
PEAK DET
(OPTIONAL) PSOPHOMETRIC FILTER
LOG
MOD SINAD
VOLT
RMS DET

A4 GEN
FM
238 KHz
AM
-7dBM
4dB PAD
PLL
LOCK DET.
UNLOCK FAULT
0-20dB RF LEVEL
60.9901-61.0099MHz
3.2MHz
PLL
70-128MHz ΔF=10KHz
AT2 20 dB
AT3 20 dB
33MHz LPF
+8 dBM
-5dBM
-21 dBM
AT1 20 dB
FROM µP
66-67MHz BPF
BP GAIN
FROM A10
FROM A10
LOAD OVERTEMP DET/ALARM
100°C
ALARM TONE
AT 4
30dB 150W
50Ω LOAD
6dB
24dB
PWR LMTR
µV
mV
PWR DET
15-150W
TO PWR MTR
TO CELL, TELE. MTR.
FROM A10

A7 DEFLECTION
AUDIO IN
SUBTONE
VERT IN
SUBTONE LPF
AUDIO AMP
VERT GAIN
CRT
VIDEO IN
ANLZR GAIN
SWEEP OSC
MARKER GEN
RF IN/OUT

PWR MTR
METER

QTY REQD	CODE IDENT	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
			PARTS LIST

NEXT ASSY	USED ON		
APPLICATION			

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS ± DECIMALS .XX ± .XXX ± ANGLES ±
MATERIAL
FINISH
DO NOT SCALE DRAWING

CONTRACT NO.

APPROVALS	DATE
DRAWN	2/9/84
CHECKED RW	3/30/84
Rel. mgr.	3/30/84

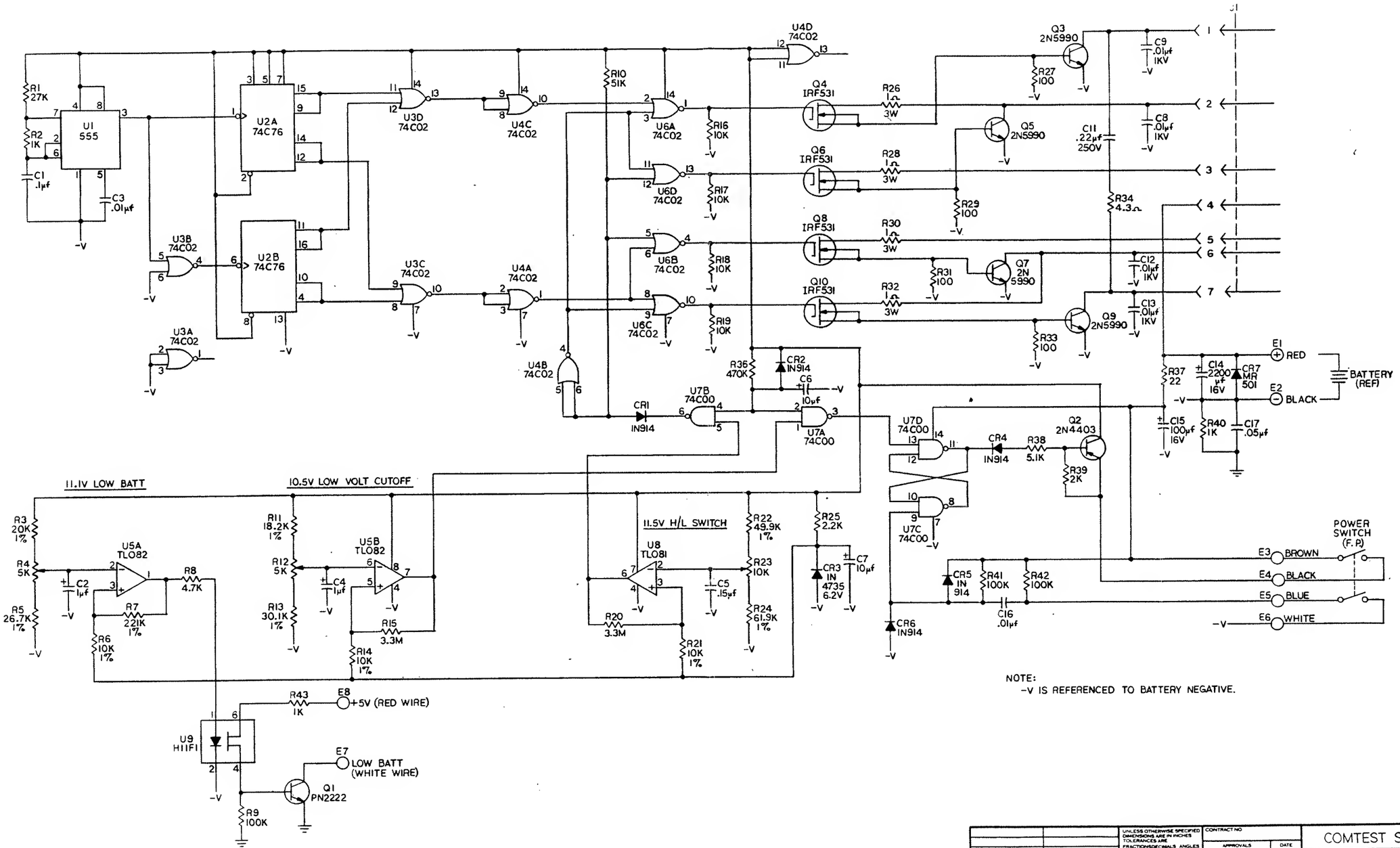
COMTEST SYSTEMS, INC.

BLOCK DIAGRAM
MODEL 3100

SIZE	CODE IDENT NO.	DRAWING NO.
D	4J835	0719-30-0001

SCALE None | SHEET 1 OF 1

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
		REV. C REDRAWN	3-21-86	DCN



NOTE:
-V IS REFERENCED TO BATTERY NEGATIVE.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ARE: FRACTIONS±1/64, DECIMALS XX ±.01, XXX ±.005, ANGLES ±30'	CONTRACT NO		COMTEST SYSTEMS, INC.	
	APPROVALS	DATE	A12 INVERTER BOARD	
	DRAWN D. NOELLER	3-21-86		
MATERIAL	CHECKED			
FINISH	RELEASED		SIZE D	CODE IDENT NO 4J835
NEXT ASSY / USED ON / APPLICATION	DO NOT SCALE DRAWING		SCALE	SHEET 1 OF 1

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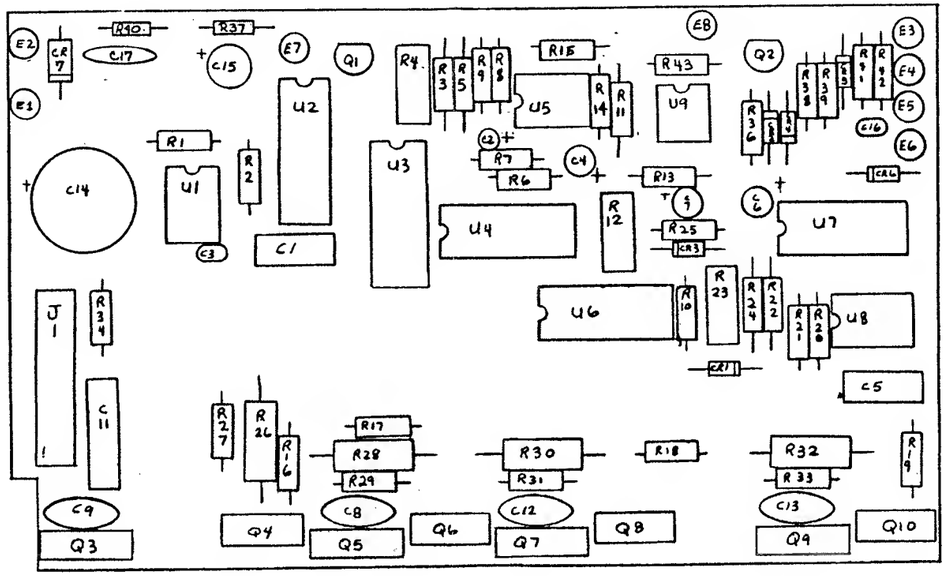
DRAWING NO 0714-30-0069

MARBAUGH

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
		REV A DCN F-1040	1-14-85	DLR



QTY REQD	CODE IDENT	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION

PARTS LIST

NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS ± DECIMALS .XX ± .XXX ± ANGLES ±

MATERIAL

FINISH

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APPROVALS	DATE
DRAWN RB	5-24-84
CHECKED RB	10-5-84

COMTEST

A12 INVERTER BD REV-3100

SIZE	CODE IDENT NO.	DRAWING NO.
C	4J835	0712-50-0069

SCALE

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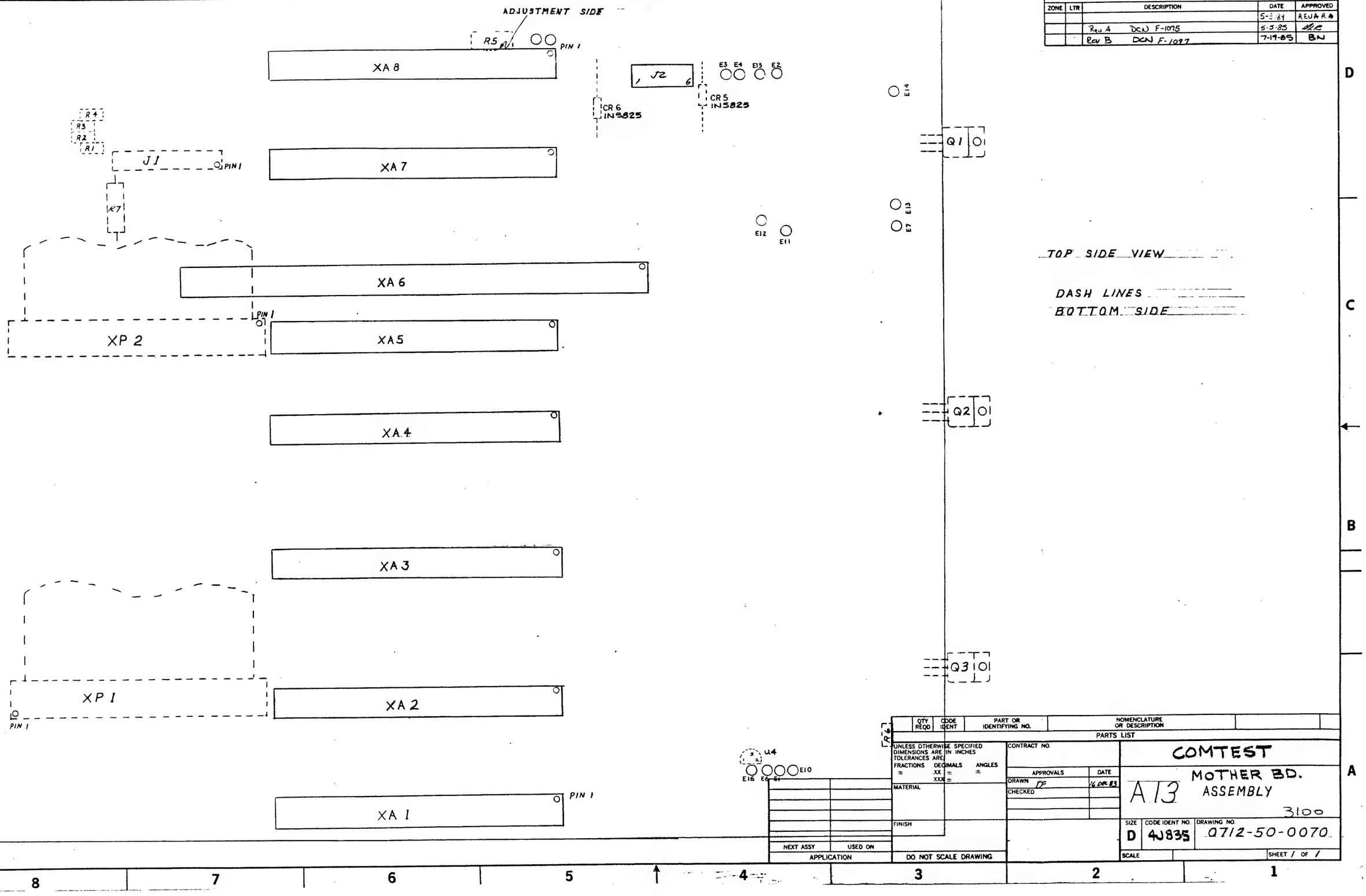
REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
			5-3-84	REVA R.A
		Rev A DCN F-1075	5-3-85	MC
		Rev B DCN F-1097	7-19-85	BN



QTY REQD	CODE IDENT	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION

PARTS LIST

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS ± DECIMALS .XX ± .XXX ± ANGLES ±

MATERIAL

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CONTRACT NO.

APPROVALS	DATE
DRAWN DE	16 DEC 83
CHECKED	

NEXT ASSY | USED ON
APPLICATION

COMTEST

MOTHER BD. ASSEMBLY

A13

3100

SIZE	CODE IDENT NO.	DRAWING NO.
D	40835	0712-50-0070

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